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AN EMPIRICAL EXAMINATION OF THE OUTCOMES OF FISCAL DECENTRALIZATION

BY

ROBERT MARTIN MCNAB

A Dissertation Submitted in Partial Fulfillment
of the Requirements for the Degree
of
Doctor of Philosophy
in the
Andrew Young School of Policy Studies
of
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ACCEPTANCE

This dissertation was prepared under the direction of the candidates Dissertation Committee. It has been approved and accepted by all members of that committee, and it has been accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Economics in the Andrew Young School of Policy Studies of Georgia State University.

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ABSTRACT

AN EMPIRICAL EXAMINATION OF THE
OUTCOMES OF FISCAL DECENTRALIZATION

by

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FEBRUARY 2001

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This dissertation develops a theoretical model of fiscal decentralization that explicitly incorporates the hypothesized outcomes of fiscal decentralization within a model of economic growth; an empirical analysis of the hypothesized effects of fiscal decentralization and the long-run influence of fiscal decentralization on growth in per capita income; and whether tradeoffs exists among the direct and indirect effects of fiscal decentralization on per capita income growth over time. We develop a neoclassical theoretical model of economic growth that provides support for the contention that fiscal decentralization influences the steady-state growth rate and the convergence path to the steady-state growth rate through its influence on economic efficiency, interjurisdictional disparities in the distribution

of public resources across subnational jurisdictions, macroeconomic stability, and democratic governance. The theoretical model also provides justification for the argument in the fiscal decentralization literature that fiscal decentralization directly influences economic growth. Finally, the theoretical model provides a framework to investigate the potential tradeoffs among the outcomes of fiscal decentralization.

We then develop an unbalanced panel data model of fiscal decentralization that spans over twenty years and over fifty countries. Using a two-way fixed effects error components estimator, we empirically investigate the influence of fiscal decentralization on infant mortality, inflation, interpersonal income disparities, democratic governance, public and private investment, and economic growth. We find that fiscal decentralization increases the rate of public investment and lowers the rate of inflation for the countries in the panel data sample. We do find limited support for the developed countries in the sample that fiscal decentralization has a direct and negative influence on economic growth while at the same time lowering the rate of infant mortality. While we find limited support for the argument that tradeoffs exist among the outcomes of fiscal decentralization for the sub-sample of developed countries, we fail to find any support for this proposition for the developing and transitional countries in the sample.

CHAPTER ONE

INTRODUCTION

Thesis

This dissertation develops a theoretical model of fiscal decentralization that incorporates the hypothesized direct and indirect effects of fiscal decentralization on growth in per capita income; an empirical analysis of the hypothesized effects of fiscal decentralization and the aggregate long-run influence of fiscal decentralization on growth in per capita income; and whether tradeoffs exists among the direct and indirect effects of fiscal decentralization on per capita income growth over time. In this dissertation, we will develop, for the first time in the literature, a theoretical model of fiscal decentralization that explicitly incorporates the more conventional effects of decentralization on economic efficiency, interjurisdictional equality in the distribution of public resources, macroeconomic stability, and democratic governance, within the model of decentralization and growth in per capita income. We will also empirically determine whether these hypothesized indirect and direct effects of fiscal decentralization significantly influence per capita income growth and the sign, significance, and magnitude of the long-term aggregate impact of fiscal decentralization on growth in per capita income. Finally, we will investigate the potential tradeoffs among the hypothesized outcomes of fiscal decentralization and discuss the policy implications of these estimates.

We believe that this course of research is timely given our current understanding of the determinants and outcomes of fiscal decentralization. There appears to be wide consensus in the literature that the level of fiscal decentralization is associated with the level of economic development, which is typically measured by per capita Gross Domestic Product, and a host of socio-economic factors, to include country size, ethnic heterogeneity, colonial history, and so on. Where consensus does not exist is with regards to the outcomes of fiscal decentralization. One point of contention is whether the assumptions underlying fiscal decentralization are applicable in developing and transitional countries. A second issue is whether decentralization exacerbates existing inequalities in the distribution of public resources across subnational jurisdictions. Disagreement also exists whether decentralization presents a significant obstacle to achieving macroeconomic stability in developing and transitional countries. Finally, while a direct relationship has been hypothesized between fiscal decentralization and growth in per capita income, there is no conclusive empirical evidence on the existence of such a relationship. Given the apparent consensus about the determinants, but not the outcomes of fiscal decentralization, we believe that the proposed course of research of quantifying the outcomes and potential tradeoffs among the outcomes of fiscal decentralization is significant and timely.

Motivation

Out of the 75 developing or transitional economies with populations greater than five million, all but 12 claim to have embarked on some type of decentralization initiative involving the transfer of power to local governments (Dillinger, 1994). Fiscal decentralization, or the transfer of fiscal authority from national to subnational governments, has come to be seen by its proponents as a tool for increasing the efficiency of public expenditures, enhancing macroeconomic stability, reducing corruption and strengthening democratic institutions, and promoting economic development. While the possibility for these gains exist, others have pointed out that fiscal decentralization may exacerbate existing disparities in the distribution of public resources across subnational governments, enhance opportunities for corruption, decrease macroeconomic stability, and retard economic development. Whether these effects exist and what is the magnitude and direction of these effects has yet to be determined.

While the topic of fiscal decentralization has spurred a large and growing literature, curiously, the effects of fiscal decentralization remain to be quantified with any degree of certainty. The more recent literature has mainly focused on the direct relationship between fiscal decentralization and economic growth (typically measured as the growth in per capita Gross Domestic Product over time), leaving the more conventional, and better understood effects of fiscal decentralization on economic efficiency, interjurisdictional disparities in the distribution of public resources, macroeconomic stability, and democratic governance, for the most part, unaddressed.[1] More importantly, the failure to address the more conventional outcomes of decentralization has meant that the potential tradeoffs between these outcomes remain to be quantified. Without this information, policymakers can not know, for example, if increases (decreases) in fiscal decentralization will induce increased economic efficiency in the provision of public services at a cost of increased disparities in the distribution of subnational public resources and decreased macroeconomic stability.

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[1] We use the terms “economic growth” and “per capita GDP growth” interchangeably throughout this dissertation.

The objective of this chapter is to briefly examine the need for a theoretical and empirical analysis of the outcomes of fiscal decentralization and to present an overview of this dissertation. The third section presents a brief discussion of the need for a theoretical analysis of fiscal decentralization that includes the direct and indirect effects of fiscal decentralization on economic growth without placing undue restrictions on the preferences of agents. In the fourth section, we provide a brief overview of the need for an improved empirical analysis of the outcomes of fiscal decentralization, to include an examination of the potential tradeoffs between the outcomes of fiscal decentralization. We conclude the chapter with a review of the structure of this dissertation.

The Need for Theoretical Analysis

Only recently have the theoretical models of fiscal decentralization included a direct linkage between fiscal decentralization and economic growth.[2] Using a representative agent modeling approach, these studies have produced insight into the hypothesized relationship between fiscal decentralization and economic growth and should be considered a valuable contribution to the literature.[3] More importantly, these models have illustrated that there is an optimal level of fiscal decentralization for economic growth, replacing the implicit assumption of previous studies of a monotonic relationship between fiscal decentralization and economic growth.

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[2] Oates (1993) hypothesized that the static proposition that fiscal decentralization is efficiency enhancing has a corresponding proposition in the dynamic setting of economic growth.

[3] See Davoodi and Zou (1998) and Zhang and Zou (1998) for examples of this approach.

While the more recent theoretical studies of fiscal decentralization have addressed the issue of the hypothesized relationship between fiscal decentralization and economic growth, the assumptions made by these studies cast doubt on the results. The primary theoretical justification for fiscal decentralization rests upon the assumption that agents in the economy have heterogenous preferences and that the central government is unable or unwilling to tailor its tax-expenditure package to more closely match the preferences of agents in the economy. Under such an assumption, the decentralization of tax and expenditure authority to subnational governments, who, due to their proximity to their agents can more effectively detect and act upon heterogenous preferences, can lead to gains in allocative efficiency. The representative agent approach assumes that the preferences of the representative agent coincide with the aggregated preferences of all the agents in the economy, a strong assumption that undermines the gains from allocative efficiency resulting from fiscal decentralization.[4] Even if the representative agent's preferences are reflective of the preferences of the population, there is no guarantee that the representative agent's preferences will continue to coincide with the aggregate preferences of the population after a change in decentralization policy.[5]

Setting aside the issue of the use of a representative agent model to examine the influence of fiscal decentralization, the theoretical models examining the influence of fiscal decentralization on economic growth have mostly focused on the direct relationship between fiscal decentralization on economic growth, even though the more conventional effects of fiscal decentralization (economic

[4] A representative agent model explicitly assumes that preferences are homogenous and thus fundamentally ignores the allocative efficiency rationale for fiscal decentralization. The use of a representative agent model also ignores the democratic governance issues associated with fiscal decentralization.

[5] See Chapter Two of this dissertation and Kirman (1992) for a further discussion of this issue.

efficiency, subnational fiscal disparities, macroeconomic stability, and democratic governance) may also influence economic growth. Failing to include these potential effects in the theoretical model may overstate (or understate) the direct contribution of fiscal decentralization to economic growth and result in omitted variable bias in the empirical estimates. More importantly, the failure to include the indirect effects of fiscal decentralization has meant that the tradeoffs between these indirect effects and economic growth have yet to be determined, an important issue for policymakers who must balance economic growth with macroeconomic stability, the equitable distribution of public resources, and other policy objectives.

The Need for Empirical Analysis

While there has been a myriad of policy discussions on the implementation and influence of fiscal decentralization, in contrast, empirical studies quantifying the hypothesized direct and indirect effects of fiscal decentralization are relatively scarce. To date, there has been no empirical examination of the influence of fiscal decentralization on economic efficiency and limited analysis of the impact of fiscal decentralization on horizontal fiscal disparities, macroeconomic stability, and democratic governance. Measurement problems aside, the lack of empirical research is surprising given that economic efficiency is the central argument for fiscal decentralization and the negative impact of fiscal decentralization on subnational fiscal equality and macroeconomic stability are the central arguments against fiscal decentralization.

The primary focus of the empirical work to date has been on the direct relationship between fiscal decentralization and economic output.[6] Initially, most empirical studies focused on the influence of the level of economic development on the level of fiscal decentralization, with the results suggesting that fiscal decentralization is a superior good. More recently, the literature has focused on the reverse question, that is, how does the level of fiscal decentralization influence economic growth? Here, the results are inconclusive, with some studies finding a positive relationship, others a negative relationship, and some no relationship at all. Curiously, none of these studies examined whether fiscal decentralization and economic growth are simultaneously determined, even though the two bodies of empirical literature suggest that the level of development influences the level of fiscal decentralization, and the level of fiscal decentralization influences the rate of economic growth.

We must note that many of the results in the literature may suffer from omitted variable bias, serial correlation, and other econometric problems. The earlier studies of the influence of fiscal decentralization rely on cross-sectional data, even though fiscal decentralization is a diffuse process whose impact may be spread over time. More recently, even though investment and the external sector have been shown to significantly and robustly influence economic growth, they have been rarely included in the analysis of fiscal decentralization on economic growth. Finally, the question of endogeneity has not been adequately addressed in the literature, which if present, may suggest why the results on the influence of fiscal decentralization on economic growth are inconclusive at this time. What

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[6] See Kee (1977), Pommerehne (1977), Bahl and Nath (1986), Wasylenko (1987), Oates (1972, 1993), Davoodi and Zou (1998), Woller and Phillips (1998), Zhang and Zou (1998), and Lin and Liu (2000).

is needed is an empirical analysis of the direct and indirect impacts of fiscal decentralization on economic growth that employs panel data and address the econometric issues discussed in this section.

Overview of the Work

The unfinished agenda in the theory and practice of fiscal decentralization is to provide understanding for how fiscal decentralization may influence its more conventional outcomes of economic efficiency, interjurisdictional equality in the distribution of resources, macroeconomic stability, and democratic governance, and how these outcomes may be associated with economic growth. Understanding these processes, and quantifying the tradeoffs associated with them, will help produce more informed policies for fiscal decentralization in developing and transitional economies. For the most part, the debate over fiscal decentralization in developing and transitional economies has focused on theory, case studies, and evidence from individual country studies of developed economies. While these approaches are not wrong and in many ways have been fruitful, they have not been sufficient to answer the difficult questions of how fiscal decentralization should proceed and what are the risks associated with fiscal decentralization.

In many countries, decentralization has now reached the implementation stage where attention must turn to specific changes in institutional structure that best support subnational governments in performing new roles. This demands information, not just on the process of decentralization in a particular country, but on outcomes, so that authorities can make mid-course corrections in their decentralization strategies (Peterson, 1996). Understanding the direct and indirect influences of fiscal decentralization on economic growth and the potential tradeoffs among these outcomes is necessary to adequately gauge the influence of fiscal decentralization on economic growth. Empirical evidence on the tradeoffs of decentralization is ultimately crucial for providing sound advice to developing and transitional economies that desire to embark on the course of fiscal decentralization.

As noted previously in this chapter, this dissertation has three objectives: First, to provide an theoretical framework for examining the direct and indirect influences of fiscal decentralization on economic growth; second to develop an empirical methodology to quantify the effects of fiscal decentralization on economic efficiency, interjurisdictional equality in the distribution of public resources, macroeconomic stability, and economic growth; and third, to quantify the potential tradeoffs among these outcomes of fiscal decentralization. The first objective seeks to address the absence in the literature of a theoretical model of fiscal decentralization that incorporates the direct and indirect effects of decentralization without imposing undue restrictions on the preferences of agents. The second objective endeavors to determine whether a statistically robust relationship exists between fiscal decentralization and economic efficiency, interjurisdictional equality in the distribution of public resources, macroeconomic stability, and democratic governance, and how through these variables, fiscal decentralization may affect economic growth. The third objective examines whether tradeoffs exist between economic efficiency, horizontal fiscal disparities, macroeconomic stability, and democratic governance, and the magnitude of these tradeoffs.

The next chapter presents a review of the fiscal decentralization literature, placing emphasis on the more recent studies that have focused on estimating the impact of decentralization and those that have discussed the existence of tradeoffs between the objectives of decentralization. First, it briefly reviews the definitions of fiscal decentralization and then examines the literature on the relationship between fiscal decentralization and economic efficiency, disparities in the distribution of resources, macroeconomic stability, and democratic governance. Next, it presents a review of the literature on the relationship, both indirect and direct, between fiscal decentralization and economic growth. We then examine the evidence for a relationship between fiscal decentralization and democratic governance. Finally, the remaining section discusses the literature on the tradeoffs associated with fiscal decentralization.

Chapter Three presents an augmented neoclassical model of economic growth that incorporates the direct and indirect effects of fiscal decentralization. The theoretical model, which is the first to explicitly model the relationship between fiscal decentralization, its outcomes, and economic growth, illustrates how the overall influence of fiscal decentralization may affect the convergence path to the steady state growth rate and the stead state growth rate itself. The chapter concludes with the presentation of the seven testable hypotheses concerning the relationship between fiscal decentralization and its outcomes including economic efficiency, horizontal fiscal disparities, macroeconomic stability, democratic governance, and economic growth and the tradeoffs between these outcomes.

Chapter Four presents the data sources that we use to estimate the hypotheses developed in the previous chapter. We then formally develop the econometric methodology used in Chapter Five to examine the testable hypotheses. Using this methodology, we construct the estimation equations that are used in Chapter Five of this dissertation to ascertain the impact of fiscal decentralization. In Chapter Five, we test for a series of econometric issues, including serial correlation, endogeneity, and heteroscedasticity before presenting the empirical results with respect to influence of fiscal decentralization. We conclude Chapter Five with an examination of the static long-term impact of fiscal decentralization on economic growth and a discussion of the potential tradeoffs among the outcomes of fiscal decentralization. We conclude the dissertation with a discussion of the policy implications of the empirical results in Chapter 6.

CHAPTER TWO

REVIEW OF THE LITERATURE

Introduction

This literature review is presented in two sections that correspond to the two main research objectives of this dissertation: the indirect and direct theoretical and empirical effects of fiscal decentralization on economic efficiency, interjurisdictional equality in the distribution of public resources, macroeconomic stability, democratic governance, and economic growth; and second, the potential tradeoffs among the hypothesized direct and indirect effects of fiscal decentralization. In this dissertation, by "fiscal decentralization," we address the delegation and devolution of fiscal authority to subnational governments and do not include the deconcentration of central government service provision. Deconcentration is not a form of decentralization in that it is a process followed by centralized governments to increase effectiveness and flexibility in the provision of government services by providing services through regional and local offices.[7] Fiscal decentralization, on the other hand, is the shift of decision making power on the composition of expenditures and often the composition and level of revenues to separately elected subnational governments.

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[7] For a more complete discussion of the difference between delegation, devolution, and deconcentration of fiscal authority see Bird (1993), Bird and Vaillancourt (1997), and Martinez-Vazquez and McNab (1998).

Fiscal Decentralization: Indirect and Direct Linkages

To date, only a small number of studies have attempted to develop a direct theoretical linkage between fiscal decentralization and economic growth. As we shall see, these studies have made a significant contribution to the literature, but, as we also shall discuss, the results of these studies are weakened by the lack of a methodology that allows for the indirect theoretical linkages between fiscal decentralization and economic growth. With this in mind, we first turn to an examination of the more conventional, direct linkages between fiscal decentralization and economic efficiency, interjurisdictional fiscal equality, macroeconomic stability, and democratic governance.

Fiscal Decentralization and Economic Efficiency

The basic argument for a fiscal decentralization program rests on four complementary assumptions.[8] First, a collective decision making mechanism exists and is relatively efficient and national and subnational governments respond to the collective decision making mechanism so that resource allocation decisions are made according to the preferences of their constituents. Second, subnational governments are more adept at matching the preferences of their constituents since they are able to alter their tax-expenditure packages to more closely match constituent preferences. Third, population mobility ensures that consumers sort themselves based upon the tax-expenditure package offers of subnational governments (Tiebout, 1956). Fourth, interjurisdictional competition implies that subnational governments efficiently provide local public goods. Therefore, if a fully efficient allocation

[8] See Oates (1972) for the seminal work on fiscal decentralization.

of resources is to be achieved within a decentralized system, households must be fully mobile and efficiently assigned to local jurisdictions that are responsive to the preferences of the consumers.

Under these assumptions, two types of efficiency gains are possible through the decentralization of fiscal authority: allocative and technical. While there is general consensus that fiscal decentralization increases allocative efficiency, the underlying assumptions for the realization of these gains, and their significance, have been brought into question with respect to developing and transitional countries. There is no apparent consensus in the literature that fiscal decentralization results in increased technical efficiency.[9] There also has been very little discussion on how these potential efficiency gains translate into increased economic growth. In this subsection, we examine what consensus does exist and what issues remain unresolved.

Oates' (1972) seminal contribution to the literature pointed out that not all public goods have similar spatial characteristics: some public goods benefit the entire country, while other public goods provide benefits only to specific subnational jurisdictions. Subnational jurisdictions are also likely to have heterogenous preferences for public goods, thus the supply of public goods must be tailored to the different tastes and preferences of the subnational jurisdictions for consumer welfare to be maximized. If the central government is unable to differentiate the provision of public goods or chooses to provide a uniform package of public goods, then the provision of public goods will be suboptimal and fiscal decentralization can lead to gains in allocative efficiency. Gains in allocative efficiency are primarily due to the ability of subnational governments to discern and act upon variations in local tastes and

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[9] Bahl and Nath (1986), Bahl and Linn (1992), and Dethier (1999a, 1999b) are among those that have noted that the potential allocative efficiency gains from fiscal decentralization may be precluded by the underdevelopment or absence of democratic institutions in developing and transitional countries.

preferences. However, when locally provided public goods and services exhibit positive externalities, the allocative efficiency case for fiscal decentralization is weakened, but not destroyed, unless benefits spill over evenly across the entire nation.[10]

Whether the efficiency gains associated with fiscal decentralization are as significant in developing as in developed countries has been a matter of contention. Western-based democratic models of expenditure assignment may not readily apply in developing countries due to the lack of voting mechanisms and the reluctance of central governments to relinquish control over local revenue authority and expenditure responsibility.[11] Subnational governments in developing and transitional countries may also lack the institutional capacity to reap the efficiency gains associated with fiscal decentralization. Decentralization might also result in increased participation at the subnational levels of government but the privileged elite may "capture" local governments, continuing the exclusion of the majority of the population from the governance process.[12] If so, decentralization may only result in the transfer of authority from the privileged elite at the central level to the privileged elite at the local level of government. The allocative efficiency gains from decentralization would then be much less than anticipated due to the inability of the majority of citizens to express their tastes and preferences. While pertinent, these arguments in the literature do not completely rule out the possibility of allocative

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[10] If the benefits spilled evenly across all subnational jurisdictions, the central government would best positioned to capture these spillovers. The existence of spillovers may also create incentives for local governments, which are unable to capture all the benefits associated with the good, to underprovide the good. See Bird (1993) for an extended discussion of this issue.

[11] See Bahl and Nath (1986), Prud'homme (1995), and Tanzi (1996, 2000).

[12] See Conyers (1990) and Dethier (1999a).

efficiency gains from fiscal decentralization. Even if there are substantial institutional constraints, allocative efficiency gains may still occur from the implementation of fiscal decentralization programs.[13]

In addition, the assumption that central governments are invariably less efficient in detecting variations in local tastes and preferences has been challenged on the grounds that in many unitary countries, central government representatives are assigned to subnational jurisdictions to assess local needs. Given the rapid development and decline in cost of communications technology, it has become possible to rapidly report and respond to the changing needs to local constituencies.[14] Central government agents may enhance coordination among subnational governments and the production of public goods that, due to the generation of positive spillovers, may not otherwise have been produced. Even if this line of reasoning prevails, the important issue is not whether the central government has better information, but whether the central government has sufficient flexibility and chooses to modify the provision of public goods within each jurisdiction based upon the information it has acquired. Central government agents may also seek to exaggerate local demand in order to maximize their power or importance. An incentive problem may also exist in that central government agents stationed at regional and local governments are accountable to the central, and not subnational, level of government. When a conflict arises between the needs and preferences of the local jurisdiction and the objectives of the central government, the agent will be biased towards the implementation of the central government program due to their employment by and accountability to the central government.

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[13] McLure (1995) and Sewell (1996) contend that allocative efficiency gains are possible even if there are substantial institutional and governance constraints.

[14] Tanzi (1996) noted that this approach has been employed in several South American countries.

It can be argued that differences in income, not differences in preferences, are more important determinants of allocative efficiency in developing economies.[15] Prud'homme (1995) argued that the underdevelopment (or lack) or voting mechanisms in developing and transitional countries may inhibit the revelation of preferences and that governments would be more responsive to variations in income for the determination of the demand for public goods. If this argument holds, the allocative efficiency gains from decentralization could still be present if local governments are better able to discern variations in local incomes and respond to differences in demand arising from these variations in incomes than the central government. Furthermore, even if preferences do not matter, allocative efficiency gains from fiscal decentralization can also occur if the expenditure pattern of the central government deviates significantly from the expenditure pattern preferred by subnational jurisdictions. If, for example, the central government invests in large, grandiose projects while ignoring the basic health and education needs of its citizens, decentralization would likely produce gains in allocative efficiency under the assumption that subnational governments would alter their tax-expenditure packages to more closely match the preferences expressed by their constituents.[16]

It is inescapable that democratically based models of expenditure assignment in general may not operate as efficiently in developing and transitional countries due to institutional constraints. However, their effectiveness is a matter of degree and while institutional constraints may limit the potential allocative efficiency gains from fiscal decentralization, they do not necessarily eliminate the potential

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[15] See Prud'homme (1995) and Tanzi (1996) for a discussion of this arguement.

[16] See McLure (1995), Sewell (1996), and Guess, Loehr, and Martinez-Vazquez (1997) for the presentation of this counter-argument.

gains arising from the implementation or expansion of a fiscal decentralization program. In summary, there appears to be a consensus in the literature that there can be an impact, although there is no consensus on the magnitude, of fiscal decentralization on allocative efficiency. In developing and transitional countries these gains are likely to be more limited. The question that needs to be addressed is how much more limited are the allocative efficiency gains in developing and transitional countries.

We now turn to the more contentious issue of the relationship between fiscal decentralization and technical efficiency. Although not as widely discussed as the relationship between fiscal decentralization and allocative efficiency, the relationship between fiscal decentralization and technical efficiency is important. If fiscal decentralization positively and significantly influences technical efficiency, then the indirect effect of fiscal decentralization on economic growth is clear. Increases in technical efficiency would allow the same level of public goods to be produced at lower cost or an increased amount for a given set of resources. Conversely, if subnational governments operate on a lower production frontier than the central government, then decentralization would lead to a decline in the quantity or quality of public good output and likely retard economic growth. The relationship between increases (or decreases) in technical efficiency and economic growth is thus better understood than the relationship between allocative efficiency and economic growth.

Public sector technical efficiency in developing and transitional countries has only recently emerged as a subject of interest in the economics literature. Zhang and Zou (1998) examined the impact of intersectoral and intergovernmental public expenditures on economic growth in China and found that fiscal decentralization is negatively associated with provincial growth. They also found that different types of expenditures had different effects on economic growth with the sign of the relationship depending on the level of government. Devarajan, Swaroop, and Zou (1996) found that not only the level but also the composition of government expenditure affects economic growth. Whether or not expenditures on certain public goods are growth enhancing depends upon the relative productivity of each good and the initial expenditure shares. Thus, a shift in favor of a more productive type of expenditure may not increase economic growth if the initial share of the good is too high, a finding that will always be true with concave production functions exhibiting decreasing returns to production with fixed factors of production. While this approach illustrated the potential gains from reallocating public resources from non-productive to productive expenditures, it failed to recognize how the intergovernmental distribution of public expenditures may also affect economic growth.

Gupta, Honjo, and Verhoeven (1997) assessed the efficiency of government expenditures on education and health outcomes in 38 countries in Africa and found that, on average, countries in Africa are less efficient than countries in Asia and the Western Hemisphere. While not directly examining the impact of fiscal decentralization on economic efficiency, the results suggested that the observed inefficiencies may be a result of relatively high government wages and the intrasectoral allocation of government resources. Furthermore, they noted that the analysis of the efficiency of government expenditures should use information contained in both inputs and outputs, and address the question of whether the same level of output could be achieved with less input, or conversely, more output with the same level of input, that is, to assess technical efficiency. La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1999) empirically investigated the determinants of the quality of governments using a large cross-section of countries. They found that poorer countries, relatively more heterogenous countries, and countries with French or socialist legal systems have lower levels of government performance.

While not directly examining the question of the influence of fiscal decentralization on government performance, these results appear to illustrate that the quality of government services is lower in developing countries than in the industrialized countries where the theory of fiscal assignment was developed.

What has been largely ignored in the fiscal decentralization literature are the technical efficiency effects associated with revenue generation by the public sector. While there has been a significant amount of discussion on the assignment of tax instruments to different levels of government, there has been an absence of discussion on the potential relationship between the level of government and the technical efficiency of various taxes. Subnational governments may be better positioned to administer some taxes (property taxes, for example) than the central government. Conversely, the central government may be best positioned to administer other taxes (Value Added Taxes, for example) whose complexity and effects necessitate uniform application across subnational jurisdictions. What remains to be examined are the technical efficiency effects of assigning these taxes to various levels of government and whether the composition of taxes at each level of government affects economic growth.

It stands to reason that if the composition of expenditures and revenues at the national level affects economic growth, that the composition of expenditure and revenues at each level of government and across levels of government will also affect economic growth. Expenditures, which are growth enhancing at one level of government, are likely to be growth enhancing at another level of government with their impact on economic growth being dependent upon the relative efficiency of each level of government. Thus, if education is growth enhancing, it will be so at any level of government, but technical efficiency may be higher at the lower level, if the hypothesis that fiscal decentralization results in increased technical efficiency is true. Devolving this function to lower levels of government would, if the hypothesis is true, would likely enhance allocative and technical efficiency and through these channels, economic growth. Conversely, certain types of infrastructure investment, most notably interregional transportation, for example, may be more effectively delivered by the central government (which is able to internalize the positive externality associated with this public good) and decentralizing this responsibility may lead to decreases in allocative and technical efficiency, which may translate to lower rates of economic growth. However, we must note that while these empirical studies have examined the relative productivity of expenditures, they have not directly examined, per se, the question of what is the impact of fiscal decentralization on technical efficiency.

Models directly examining the relationship between fiscal decentralization and economic growth have largely ignored the potential impact of fiscal decentralization on technical efficiency.[17] Most of these studies have treated public expenditures at all levels of government as identical. That is, a one dollar increase in expenditures at the national level of government results in the same increase in output as a one dollar increase in expenditures at the subnational level of government. This is an important assumption in these models and one that effectively negates any potential technical efficiency gains (as well as allocative efficiency gains) resulting from fiscal decentralization. Other studies (Lin and Liu, 2000) that have recognized the potential technical efficiency gains resulting from fiscal decentralization have not investigated the separate effect of decentralization on technical efficiency and merely have assumed that the technical efficiency effect is captured by the estimated coefficient for fiscal

[17] Nath and Purohit (1995), Panizza (1998), Davoodi and Zou (1998), and Woller and Phillips (1998), and Lin and Liu (2000) are some of the most recent examinations of the relationship between fiscal decentralization and economic growth.

decentralization. Given that the assumption that each level of government operates on the same production frontier is an exceedingly strong assumption, specially in the case of developing of transitional countries, we believe it is reasonable to conclude that this assumption does not hold and that the results of these models are therefore called into question.

The anecdotal case for fiscal decentralization leading to increases in producer efficiency is that it fosters experimentation and innovation in the provision of goods and services. In particular, subnational governments in many countries have been in the vanguard of privatization of public services. Fiscal decentralization allows subnational governments to serve as laboratories for national policy reforms so that proposed systems can first be tested on a small scale and tailored to local conditions and preferences. If the citizens of one subnational government evaluate the performance of their officials in terms of performance relative to other subnational governments, then the forces for adopting superior programs that enhance local welfare are strengthened.[18] While insightful, these arguments have been questioned for the case of developing and transitional countries where it is likely that central government bureaucracies operate closer to the technical production frontier, even though both central and local bureaucracies probably operate far from this frontier. Contrary to conventional wisdom, local governments may not necessarily be better innovators than central governments. Local governments may forgo innovation and free-ride off the policy experiments of other local governments. Centralized

[18] Gramlich (1987) and Salmon (1987) are two of the proponents of using fiscal decentralization to increase competition and innovation among subnational governments.

government results in greater experimentation when local governments are relatively homogeneous or large in number (Strumpf, 1999).[19]

Whether subnational governments in developing and transitional countries are as efficient and innovative as central governments remains a significant point of contention in the literature. Placing decision making authority in the hands of those who have information on local tastes and preferences provides strong incentives for the more efficient provision of local public goods (Bardhan, 1997). If capital resources are inefficiently allocated by the central government, then decentralization may raise the rate of return to public capital, create incentives for subnational governments to develop their own revenue sources, and increase long-run economic growth (Lin and Liu, 2000). On the other hand, these arguments are based upon the assumption that subnational governments are as technically efficient as central governments.[20] Prud'homme (1995) noted that in many developing and transitional countries central governments offer more opportunities for advancement and are viewed as the first choice of prospective public sector employees. Central governments may also be able to dedicate a greater percentage of resources to process improvements (information technology, employee education) and may be better positioned to capture the positive externalities associated with these actions. Central governments may also be able to take advantages of economies of scale for some public goods (transportation, public utilities) that may be unobtainable by subnational governments.

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[19] Using a game-theoretic approach, Strumpf (1999) concluded that while local governments can simultaneously consider multiple policies, they each ignore the positive externality that occurs with innovation: that every other local government has full knowledge of their innovation and its outcome.

[20] Sewell (1996) argued that sufficient evidence exists to support the contention that many subnational governments in developing and transitional countries are as (or more) efficient as central governments with respect to the provision of public goods.

In summary, there appears to be a plausible rationale in the literature for the existence of a relationship between fiscal decentralization and technical efficiency. As a maxim, studies addressing fiscal decentralization and economic growth have implicitly ignored this relationship. The literature still needs to develop a theoretical framework that incorporates the potential for efficiency gains (or losses) from the implementation of a fiscal decentralization program, and there is a need as well to measure how significant these gains (or losses) may be. We now turn to the relationship between fiscal decentralization and the distribution of resources.

Fiscal Decentralization and Resource Distribution

There appears to be a general consensus in the literature that, all else being equal, unrestrained fiscal decentralization is likely to exacerbate horizontal fiscal inequities.[21] Evidence from decentralization efforts in Latin America suggests that the excessive concentration of wealth in large Latin American cities in the 1980's had its origins in the amassing of subsidies flowing from tax assignment and from the failure to explicitly state the diseconomies of resource concentration (Murphy, Libonatti, and Salinardi, 1995). Severe horizontal fiscal imbalances exist in many developing and transitional countries, but in many cases these conditions existed before fiscal decentralization and have not been explicitly addressed through the implementation of an equalization program (Shah, 1999). If the design of the intergovernmental system is flawed, increases in horizontal and vertical imbalances may result.

[21] See Prud'homme (1991), Gramlich (1993), Tanzi (1996, 2000), Guess et al. (1997), Martinez-Vazquez and McNab (1998, 2000), and Shah (1999), among others.

Vertical fiscal balance aside, horizontal fiscal inequities may arise due to the differential demand for spending arising from heterogeneous preferences or from differences in the per capita tax base. If preferences are heterogeneous, the consensus in the literature is that, from the standpoint of distribution, net tax pressure (tax contributed minus services received from the public sector) should be vertically progressive, that is, positively correlated with per capita income.[22] Furthermore, there appears to be general agreement that two citizens of the same country should be subject to the same net fiscal pressure, regardless of their geographical location. Per capita variations in income may result in horizontal inequities in the distribution of public resources if the decentralized system does not explicitly account for these variations.[23] Constituents living in poorer jurisdictions must contribute a higher portion of their income to receive the same bundle of public goods relative to constituents living in wealthier jurisdictions. Variations in demographic and geographic environment may also exacerbate horizontal imbalances. One of the most significant dangers associated with fiscal decentralization is that it can exacerbate political tensions between regions, specially if significant horizontal fiscal balances exist.[24] If decentralization results in increased horizontal fiscal disparities, then the political climate between subnational governments may deteriorate. This issue is more important for developing and transitional countries where horizontal fiscal disparities appear to be more significant than in developed countries. As noted previously in this chapter, the theory of fiscal assignment was developed in an

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[22] See Murphy, Libonatti, and Salinardi (1995) for further discussion of this issue.

[23] See Oates (1972, 1993) and Bahl and Linn (1992)

[24] Dethier (1999a) presented an extended discussion of how horizontal fiscal disparities may create political tension.

environment characterized by well developed subnational institutions with substantial tax bases and a capacity to tax their constituents. In many developing and transitional countries, subnational institutions are weak and their capacity to tax their constituents is underdeveloped.

We must note, however, that there is a clear argument to be made that the potential for equalization is greater in a centralized public sector (Bahl, 1999b). Central governments have greater resources to distribute and thus a greater potential for equalization. However, while central governments may have a greater capacity for equalization, this does not necessarily lead to the conclusion that relatively more centralized countries have more equitable distributions of subnational resources. For the case of the Philippines, the previous centralized system under President Marcos had significant variation in the distribution of public resources across regions, with the allocation being determined primarily by political factors (Bird and Rodriguez, 1999). Institutional arguments and anecdotal evidence aside, whether or not governments choose to equalize is a question of policy, yet, a priori, there does seem to be a rationale for why fiscal decentralization may be counter equalizing. What remains to be tested if whether decentralized systems are more horizontally fiscally inequitable and whether this potential inequity significantly influences economic growth.

Fiscal decentralization may also significantly influence interpersonal equity through public expenditure and tax policy and the design of intergovernmental transfers (Litvack, Ahmad, and Bird, 1998). If decentralization results in a higher tax burden on the poor through increased user fees and local taxes, the interpersonal inequity is likely to increase over time. However, if decentralization results in a more efficient allocation of public services and a more equitable distribution of these services, away from large infrastructure investments to public health and education, for example, then interpersonal inequity may decrease over time. Whether decentralization significantly affects income inequality is a question yet to be examined.

What has been empirically examined in the literature is the relationship between fiscal decentralization and the distribution of private resources. Panizza (1998) examined the reverse question, that is, whether income inequality leads to more centralization, by incorporating income inequality into the empirical analysis of the determinants of fiscal centralization. He noted that agents with different levels of income are likely to have different preferences on the type, quality, and quantity of public goods. On the basis of this conclusion, he argued that income inequality is a good measure of demand differentiation and that the greater the differentiation of demand, the lower the level of fiscal centralization (or the higher the level of decentralization). Following this argument is the presumption that more centralized public sectors will attempt to produce a more geographically balanced distribution by redistributing resources from richer jurisdictions to poorer ones.[25] Using aggregate data on Gini coefficients for 48 countries, Panizza (1998) found only a weakly significant relationship between income inequality and the level of fiscal centralization. He did not, however, examine the direction of causality between fiscal decentralization and income inequality nor did he examine the potential impact of fiscal decentralization on economic growth.

What has also been examined in the literature are the linkages between corruption and income inequality. This line of inquiry is important in that one of the arguments put forward against fiscal decentralization is that it increases opportunities for corruption in developing and transitional

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[25] Bertola (1993), Alesina and Rodrik (1994), Persson and Tabellini (1994), and Bahl (1999b) are among those that have noted that more centralized countries have a greater ability to equalize subnational fiscal resources.

economies.[26] Guess et al. (1997), on the other hand, have argued that decentralization increases the transparency of government operations and reduces the opportunities for corruption. In either case, corruption can affect income inequality through a variety of channels, including overall economic growth, discriminating or unfair tax systems, poor targeting of social expenditures, as well as, through its impact on asset ownership, human capital formation, education inequalities, and uncertainty in factor accumulation.[27] There is some empirical evidence that countries with lower levels of income inequality grow faster relative to countries with higher levels of income inequality, which, for those arguing that decentralization leads to increased corruption, has led to the conclusion that decentralization increases income inequality, which in turn retards economic growth.[28] However, the results of these studies maybe suspect as other studies have failed to detect a statistically significant and robust relationship between income inequality and economic growth.[29] Two factors may explain why there is no consensus in the literature whether a statistically robust relationship exists between income inequality and economic growth. First, it is not entirely clear whether the small sample of countries employed in

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[26] Prud'homme (1995), Tanzi (1994, 1997, 2000), and Rose-Ackerman (1997) have all argued that the probability for corruption is higher in more decentralized countries.

[27] See Shleifer and Vishny (1993) for a review of the corruption literature; Mauro (1995, 1996) for the first empirical analysis of the impact of corruption on economic growth; Rose-Ackerman (1997) for a review of effects of corruption in developing countries; and Gupta, Davoodi, and Alonso-Terme (1998) for an examination of whether corruption affects income inequality.

[28] Alesina and Rodrik (1994), Persson and Tabellini (1994) and Birdsall, Ross, and Sabot (1995) are among those that have found that increases in income inequality induce lower rates of economic growth. Panizza (1999) found that income inequality negatively and significantly influences economic growth for a sample of U.S. states and suggested that fiscal policy, specifically tax progessivity, influences inequality which in turn influences economic growth. Forbes (2000) determined that contrary to conventional wisdom, increases in income inequality increase economic growth in the short and medium-term.

[29] Deininger and Squire (1996), whose panel data set is the foundation for many recent empirical studies on the relationship between income inequality and economic growth, failed to detect a statistically significant relationship between these two variables.

the analysis of income inequality influenced the result. Second, and more important, the income inequality variable may merely be a proxy for the fertility rate, and once the fertility rate is included in the empirical analysis, the income inequality variable may lose explanatory power.[30] That previous studies of this issue have found a statistically significant relationship between income inequality and per capita GDP growth may be a result of misspecification as income inequality may merely be proxying for the relationship between fertility and economic growth.

Does fiscal decentralization result in increased corruption? While this question has yet to be addressed in the literature, some have suggested that corruption is likely to increase when central government authority declines or fails and that corruption is more prevalent in federal systems.[31] Federal states may be perceived to be more corrupt than unitary states due to three factors: federal states are typically larger than unitary states, implying diminishing returns to reducing corruption; the existence of separate police forces at multiple levels of government; and a higher likelihood of having a bicameral legislature where the upper house is regionally elected and posses veto power (Treisman, 1999). Recent empirical evidence suggests that states which have more tiers of government are perceived to be more corrupt and less efficient at providing public health and literacy services (Treisman, 2000). These results also appear to refute the argument that increased decentralization will lead to increased competition among subnational jurisdictions. We must note, however, that while

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[30] Barro (1999), using a panel data set of over 80 countries, found that income inequality did not statistically contribute to economic growth when one controlled for the fertility rate.

[31] While not specifically addressing the question of whether fiscal decentralization results in increased corruption, Shleifer and Vishny (1993) argued that rent-seeking activities increase when the role of the central government in society declines.

these results are among the first in the literature to investigate the relationship between political decentralization and public good outcomes, they are subject to the same criticisms as the other recent studies of the impact of fiscal decentralization. On the other hand, decentralization may reduce opportunities for corruption in that local policymakers are more visible to their constituents and corrupt behavior is more likely to be noticed than at the central level of government.[32] The question that remains to be examined is whether fiscal decentralization results in increased corruption, increased income inequality, or both. This is another question that awaits empirical examination.

In summary, there is a lack of theoretical development and empirical evidence on the relationship between fiscal decentralization, horizontal fiscal inequities, and income inequality. There is a need to empirically examine the proposition whether fiscal decentralization results in increased corruption, and in turn, increased income inequality. There is also the need to empirically examine whether fiscal decentralization results in increased inequalities in the subnational distribution of public resources. Addressing these questions systematically may help resolve the, so far, anecdotal debate in the literature on the impact of fiscal decentralization on the distribution of public and private resources.

Fiscal Decentralization and Macroeconomic Stability

There is considerable controversy in the fiscal decentralization literature as to whether or not fiscal decentralization works against macroeconomic stability. However, there is general consensus that poorly designed systems can easily lead to macroeconomic instability if, for example, subnational governments are allowed to operate under a soft-budget constraint. The evidence establishing a

[32] Murphy et al. (1995), Sewell (1996), Guess et al. (1997), and Martinez-Vazquez and McNab (1998, 2000) are among those that have suggested that decentralization reduces corruption.

relationship between fiscal decentralization and macroeconomic stability is scant at best and does not present a convincing argument in either direction on the effect of fiscal decentralization.[33]

Musgrave (1959, 1983) and Oates (1972) contended that the macroeconomic policy should solely be the responsibility of central government monetary and fiscal policy authorities and not at all the responsibility of subnational governments. It would be inappropriate for a multiplicity of cyclical strategies to exist at each level of government. There is little argument to be made on the issue of monetary policy. With respect to fiscal policy, the argument to keep the responsibility at the central government level is that subnational governments have highly 'open' economies, that is, they export and import large shares of goods that they produce and consume. Such openness calls into question the ability of subnational governments to employ countercyclical fiscal measures in that any measure would be effectively leaked out of the jurisdiction. Recently, a counter-argument has emerged in the literature that devolving at least some measure of macroeconomic policy to subnational governments promotes, not hinders, macroeconomic stability.[34]

First, the conclusion that macroeconomic policy is solely the responsibility of the central government is based upon the assumption that economic shocks are symmetrically distributed. In many cases, macroeconomic shocks are asymmetrically distributed and subnational governments may be better positioned to respond to asymmetrical shocks than the central government (Gramlich, 1993). Second, the case for Keynesian demand management is based upon the assumption of a closed

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[33] See Shah (1999) for a survey of the literature on the relationship between fiscal decentralization and macroeconomic stability.

[34] See Gramlich (1993), Sewell (1996), Spahn (1997), and Shah (1999).

economy. In an open economy, any national fiscal stimulus would be offset by a change in the exchange rate if exchange rates are sufficiently flexible (Spahn, 1997). Furthermore, if there were an appropriate subnational fiscal stimulus to asymmetrically distributed economic shocks, then if the shocks summed to zero, this approach could be employment stimulating but neutral with respect to the exchange rate (Gramlich, 1987, 1993). Third, the argument for a centralized macroeconomic policy has implicitly assumed segmented capital markets in which subnational governments face higher borrowing costs relative to the central government. In fact, capital markets tend to be more open than closed and risk premiums are not based on the level of government but on the capacity of the government to service its debt.

Finally, the case for centralized macroeconomic policy rests upon the assumption of non-cooperative behavior on the part of subnational governments. The experience of many countries suggests that fiscal decentralization aggravates macroeconomic instability or at least presents another obstacle to resolving chronic fiscal imbalances. In several developing countries, subnational governments operated under a soft budget constraint and increased macroeconomic instability as their borrowing eventually led the central government to assume the servicing of the subnational debt (Tanzi, 1996). Where macroeconomic instability predated decentralization, for example, for the case of Argentina and Brazil, decentralization has made the solutions more complicated in general but not impossible (Dillinger and Webb, 1998). Even if this thesis is accepted, any such predilection can be controlled through appropriate fiscal arrangements, to include suitable assignment of revenues and expenditures and a well-conceived system of intergovernmental transfers (Spahn, 1997). This conclusion is supported by the observation that, on the basis of achieving macroeconomic stability, there does not appear to be a basis for major changes in expenditure assignments in the majority of countries (Ter-Minasian, 1997). However, in many countries, including Russia and China, the presence of a soft-budget constraint at the local level of government remains a threat to macroeconomic stability.

Burki, Perry, and Dillinger (1999), using a panel data set of 32 countries, found that there is an almost 1-to-1 correspondence between increases in subnational deficits and central government expenditures and deficits in the subsequent period. This result is statistically significant and appears to imply that the transitional path to a decentralized system typically causes problems for macroeconomic stability. The result appears to be robust to the inclusion of democratic governance and central bank independence variables. Curiously, Burki et al. (1999) failed to examine whether the result is robust with the inclusion of the Levine and Renelt (1992) conditioning variables. They also did not include investment and international trade in the empirical analysis, raising the question of whether the finding is a result of a misspecified model.

While the assumptions underlying the argument for centralized macroeconomic policy may be called into doubt, the question still remains whether or not fiscal decentralization increases macroeconomic instability. Prud'homme (1995) and Tanzi (1996, 2000) have strongly argued that fiscal decentralization exacerbates instability, or at the minimum, hinders attempts to promote stability. In developing and transitional countries, the primary macropolicy objective may not to be counter economic cycles, but rather to bring about adjustment so as to reduce fiscal imbalances. Decentralization presents yet another obstacle to reducing fiscal imbalances. If fiscal decentralization does result in greater macroeconomic instability, then it is likely that fiscal decentralization will indirectly retard economic development in that there is ample empirical evidence to support the contention that macroeconomic instability does lead to lower rates of economic growth.[35]

While the arguments linking fiscal decentralization and macroeconomic stability should be taken into consideration, we should note that these arguments are primarily institutional in nature, that is, there is no a priori theoretical reason why fiscal decentralization induces macroeconomic instability and, in turn, retards economic growth. In fact, decentralized governance would require a clarification of the roles of central and subnational government institutions and the strengthening of the framework within which these institutions would operate (Huther and Shah, 1996; Shah, 1999). Cukierman, Webb, and Neyapti (1992) found that there a positive correlation exists between price stability and central bank independence. Huther and Shah, using the data on central bank independence from Cukierman et al.(1992), noted that a weak but positive correlation exists between the level of fiscal decentralization and central bank independence, suggesting that central bank independence does indeed strengthen under decentralized systems. The finding that price stability and central bank independence are positively correlated suggests that price stability and fiscal decentralization may also be positively correlated. We believe that this suggests a need for a theoretical and empirical examination of the relationship between fiscal decentralization and macroeconomic stability and whether decentralization leads to greater instability which in turn retards economic growth.

Fiscal Decentralization and Democratic Governance

[35] See Barro (1991, 1999) and Fischer (1993), among others.

Decentralization, in the final analysis, is a political process that may be justified in economic terms. Democratic governance, and with it decentralization, has come to be viewed as a strategy to maintain political stability, and as such, constitutes an alternative to civil war or other violent forms of opposition (Burki et al., 1999).[36] Unlike the relationship between fiscal decentralization and economic growth, some have argued that there appears to be an unambiguous, mutually reinforcing relationship between fiscal decentralization and democratic governance.[37] Decentralization promotes democratic governance and democratic governance is required to reap the full benefits arising from fiscal decentralization.[38] Anecdotal evidence suggests that decentralization efforts have had positive impacts on public participation and public-sector accountability (Blair, 1998). On the other hand, democratic governance does not appear to be a necessary condition for the realization of gains arising from fiscal decentralization. China, which has aggressively decentralized over the past decade, provides a counter-argument to those arguing that democratic governance is a necessary condition for the realization of gains resulting from fiscal decentralization.[39]

Only recently has interest in the effect of democratic governance reemerged in the economics literature.[40] Recent empirical evidence suggests that democratic governance positively and significantly

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[36] See Burki et al. (1999) and Dethier (1999a, 1999b) for an extended discussion of this issue.

[37] The World Bank (1992) defines governance as " the manner in which power is exercised in the management of a country's economic and social resources. See also Dethier (1999a, 1999b).

[38] See Putnam (1993) and Martinez-Vazquez and McNab (1998).

[39] See Bahl (1999a) for an in-depth analysis of taxation and intergovernmental fiscal relations in China.

[40] Scully (1988), Grier and Tullock (1989), and Barro (1991, 1996, 1999) are among those who have found that democratic governance influences economic growth.

influences economic growth and that democratic governance issues play an important role in the analysis of fiscal decentralization.[41] In response to these issues, several recent articles have put forward the argument that democratic governance should be a part of the normative set of objectives for the design of fiscal decentralization and a condition that must be satisfied for effective decentralization in developing and transitional countries.[42]

The impetus for fiscal decentralization in Africa, Eastern Europe, Latin America, and the former Soviet Union has been the democratization of the political systems in many of these countries (Rondinelli and Nellis, 1986; Taillant, 1994). Peterson (1996) argued that the impetus of fiscal reform toward more decentralized systems has been instrumental in implementing more meaningful democratic governance at the subnational level in developing and transitional countries. Fiscal decentralization has been viewed as strengthening democratic governance at the subnational level and providing a political mechanism for curbing the powers of the central government (Martinez-Vazquez and McNab, 1998). These observations suggest bi-directional causality between fiscal decentralization and democratic governance. Whether this relationship exists and the magnitude of the relationship is yet to be determined.

Constraints on Democratic Governance. Whether or not a country is able to secure the benefits of democratic governance and its ancillary influence on the effectiveness of fiscal

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[41] See Przeworski and Limongi (1993) for a survey of the literature on the effect of political regimes on economic growth. Campbell (1993), Guess et al. (1997), Bird and Vaillancourt (1997), Martinez-Vazquez and McNab (1998), and Dethier (1999a) have all noted the importance of democratic governance issues with respect to fiscal decentralization.

[42] See Guess et al. (1997), Martinez-Vazquez and McNab (1998), and Bahl (1999b).

decentralization may be dependent upon a combination of institutional and social factors. A common criticism in the literature is that the various economic theories underlying the motivation for democratic governance and fiscal decentralization were developed to describe the fiscal structure of industrialized countries.[43] Conditions in developing and transitional countries differ significantly from those in industrialized countries with respect to voting mechanisms, public accountability, and other institutional factors. Democratic governance may require a minimum level of literacy, basic institutional capabilities, and a measure of gender equality (Dethier, 1999b). The potential virtues of fiscal decentralization are, in part, dependent upon political accountability (Bird and Rodriguez, 1999). Public accountability alone may be insufficient for benefits of decentralization to occur, local officials must also have the authority to determine and implement revenue and expenditure policies (Burki et al., 1999). In this sub-section, we examine the potential constraints on democratic governance and what influence these constraints may have on the outcomes of fiscal decentralization.

A potential constraint on democratic governance and fiscal decentralization is that local officials, even if they are popularly elected, may be subservient to the needs of the local elites.[44] If the preferences of the local elites differ significantly from those of majority of voters, decentralization may harm allocative efficiency if the central government is more responsive to the tastes and preferences of

[43] Bahl and Nath (1986), Prud'homme (1991, 1995), Tanzi (1996), and Litvack et al. (1998) are among those who have noted that the assumptions of western oriented models of fiscal assignment may not apply in developing and transitional countries.

[44] Conyers (1990), Oates (1993), Tanzi (1996), Bardhan and Mookherjee (1998), Martinez-Vazquez and McNab (1998), and Alesina (1999), among others, have all expressed concern about the domination of local elites.

the majority of voters.[45] If the central government is itself controlled by a cadre of national elites, then it is probable, as population heterogeneity increases, that decentralization might still enhance allocative efficiency, especially for those jurisdictions that differ significantly from the center.

Another potential issue in fiscal decentralization is capture by local interest groups. Capture occurs when local elites or interest groups seize the benefits of local public goods and in turn control the local government. Capture creates a series of problems including overstatement of the cost of provision of local public goods, corruption, and diversion of local public goods to non-intended groups. Capture may also have the reverse effect, that is, the local elite may wish to understate the demand for local public goods so as to lower revenue requirements and taxes. If local capture was sufficiently large, decentralization would decrease allocative efficiency and public welfare (Bardhan and Mookherjee, 1998). However, if the central government is also subject to capture, competition among regional interest groups may lower the return to capture at the subnational level of government relative to the central level of government and decentralization may indeed increase allocative efficiency.[46] Thus, assessing the impact of fiscal decentralization on poverty alleviation, for example, requires analysis of not only the level of expenditure but also the effects of institutional incentives that determine how public resources are spent and to whom the benefits accrue.

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[45] The ability of local elites to capture local governments may be dependent upon how local officials obtain office. Local officials who are appointed and report to a higher level of government may be less prone to capture than officials who are popularly elected. It may be that officials that obtain office through party elections are most prone to capture under the assumption that local elites will sponsor the party that most accurately reflects their interests. These questions await future research.

[46] See Shleifer (1997) for an examination of the effects of capture on economic development in Russia relative to Poland since the beginning of transition.

In Latin America, sub-Saharan Africa, and some Asia countries (the Phillippines and Indonesia), public consumption and transfers have often been mistargeted, have not reduced income inequality, and have largely supported special interests (Alesina, 1999). Rampant corruption and bureaucratic inefficiency have exacerbated the capture of the public sector by national elites. There appears to be a high correlation between the length of tenure of heads of state in sub-Saharan Africa countries and political oppression, corruption, and economic stagnation (or outright decline) (Gray and McPherson, 2000). Improving government performance to achieve social objectives requires a transition from a tax-avoiding, informal economy to a tax-paying, formal economy (Loayza, 1996; Alesina, 1999). As noted by Tanzi (1998), improving governance is a difficult, but necessary task, in order to reduce income inequality and increase economic efficiency and growth. The question is whether decentralization reduces or enhances opportunities for capture and corruption.

In practice, democratic governance, to include frequent and open elections, a free press and mass media, and rule of law may serve to prevent local (and national) capture of public resources by a minority elite.[47] Fiscal decentralization devolves power from the center, increasing the visibility of local government operations and reducing the return from rent-seeking behavior. Democratic decentralization has been taking place in developing and transitional countries and case studies suggest that many new constituencies gain representation through public office (Blair, 1998). Furthermore, democratic decentralization has been used by many countries to increase local autonomy with the objective of diffusing separatist movements and to accommodate autonomic feelings of some regions

[47] See, for example, Blair (1998), Martinez-Vazquez and McNab (1998), Burki et al. (1999), and Dethier (1999a, 1999b).

without leading to secession (Litvack, 1994, Bahl, 1999b). This evidence suggests that the concern over local elite capture diluting democratic governance and the allocative efficiency gains from fiscal decentralization may be overstated. We would argue that there is not a plausible a priori presumption, nor empirical evidence, to conclude that the potential problem of elite capture is more significant in decentralized systems.

Given our previous discussion of the relationship between fiscal decentralization and corruption, it is important to examine whether fiscally decentralized systems are relatively more corrupt than fiscally centralized systems. As noted previously, corrupt behavior on the part of local officials would reduce and might eliminate the potential benefits of fiscal decentralization. Corrupt behavior would also reduce private incomes (as citizens must pay bribes to receive public services for which they have already paid taxes) and increase income inequality (as the tax structure is modified to favor those who have sufficient resources to influence government officials). In some developing countries there is a widespread belief that corruption is deeply ingrained in local government institutions.[48] The empirical evidence on the existence of a relationship between fiscal decentralization and corruption is limited and much work remains to be done in this area.[49]

Corruption is enhanced by the presence of monopoly powers and discretion and is diminished by the presence of accountability (Klitgaard, 1988). If decentralized governance limits the monopoly power of centralized governments and makes government more accountable to the local constituencies,

[48] Corruption, in fact, takes many forms from the formal inclusion of exemptions in the tax structure that favor certain segments of society to bribes to tax assessors, kickbacks or other side payments in the awarding of contracts or through political patronage in the appointment of local employees. See World Bank (1997).

[49] See Tanzi (1998) and Shah (2000) for recent reviews of the decentralization and corruption literature.

then decentralization may help reduce corruption. In addition, the potential for the realization of economic rents is larger in the case of central government policies such as import quotas or tax privileges. The damage inflicted by corruption at the central level can be several orders of magnitude greater than what can be inflicted at the local level due to increased access to resources and capital markets. Local officials have limited powers and budgets, thus the return to rent-seeking behavior at the local level of government is small relative to the center. Local democratic governance may further reduce the return to rent-seeking behavior through increased accountability and visibility. On the other hand, corruption is likely to be more prevalent at the local level because there is more opportunity and pressure by local interests, and local officials may have more discretion and fewer obstacles because of the often blurred distinction between politicians and bureaucrats.[50] Recent empirical evidence suggests that political decentralization benefits the poor by creating conditions for increased citizen participation and monitoring of the bureacracy (Grote and von Braun, 2000). While there appears to be an unambiguous relationship between political decentralization and poverty reduction, there is no clear consensus or empirical evidence whether resource decentralization (the decentralization of expenditures and revenues) reduces poverty over time. Grote and von Braun suggest that minimum levels of subnational expenditures appear to be a pre-condition for poverty reduction, but that the influence of subnational expenditures on poverty reduction declines in the margin. If local governments deliver essential services (water and sewage, health, and education) and decentralization leads to increased corruption, the quality and quantity of these services would likely decline, further reducing the quality of

[50] Prud'homme (1995), Tanzi (1994, 1996, 2000), and Rose-Ackerman (1997) have contended that decentralization in developing and transitional economies induces rent-seeking activities by public and private citizens alike.

life. At this time, however, there is no clear empirical evidence on the relationship between democratic governance, fiscal decentralization, and corruption.

Decentralization and Governance: Empirical Evidence

As with the question of the impact of fiscal decentralization on economic efficiency, equality in the distribution of public and private resources, and macroeconomic stability, there is a limited amount of empirical evidence on the relationship between fiscal decentralization and democratic governance. Whether fiscal decentralization is preceded by the emergence of democratic institutions, whether fiscal decentralization encourages the establishment of local democratic institutions, or whether fiscal decentralization and subnational democratic governance occur at the same time is a question to be determined. We can, however, make some general observations based on the existing literature.

First, case studies of decentralized systems in developing countries that have dedicated attention to governance issues find that democratic representation and general governance institutions in some developing countries with democratic regimes can be extremely weak to a degree that compromises the value or effectiveness of fiscal decentralized institutions (World Bank, 1997). Second, there is evidence, at least in Latin America and Sub-Saharan Africa, that decentralization has helped to strengthen democratic governance in countries that have decentralized their public finances (Martinez-Vazquez and McNab, 1998). Fiscal decentralization has complemented existing democratic institutions and encouraged citizen participation in local governance. These improvements have come in the form of direct election of mayors and councils, open council meetings, and several other forms of citizens participation. There is also evidence from polls and surveys that decentralized governance gets high approval marks from citizens and that people seem to trust local governments more than central governments (World Bank, 1997). A particularly successful innovation in citizen participation in fiscal and management decisions at the local level in Latin America has been the creation of social investment funds (World Bank, 1995). The key to success of the social investment funds has been that they require a high degree of local resident involvement. However, rather than strengthening local governments, these funds have often tended to create institutions parallel to them. While these case studies are useful in imparting the experiences of specific countries, much work remains to be done on the relationship between fiscal decentralization and democratic governance.

Curiously, while democratic governance and fiscal decentralization have emerged in the past decade as potentially important determinants of economic growth, there is an absence of empirical analysis on the relationship between fiscal decentralization and democratic governance. The case studies and empirical analyses in the literature suggest that a causal relationship exists between decentralization and democratic governance but whether this relationship is uni or bi-directional remains unknown. This is another question that awaits future research.

Fiscal Decentralization and Economic Growth

We now turn to an examination of the relationship between fiscal decentralization and economic growth. To date, the majority of the empirical studies in the literature have focused on the question of what is the direct relationship between economic growth and fiscal decentralization, setting aside the question of how fiscal decentralization may affect other economic variables, which in turn influence economic growth. In this sub-section, we first examine the arguments for and against a direct relationship between fiscal decentralization and economic growth, and secondly the potential, indirect relationships between fiscal decentralization, economic efficiency, interjurisdictional equality, macroeconomic stability, democratic governance, and economic growth.

Decentralization and Economic Growth: Direct Effects. It is not clear whether a direct casual relationship exists between fiscal decentralization and economic growth. Extensive decentralization may be prohibitively expensive for developing countries, suggesting that decentralization may slow economic growth.[51] While this line of reasoning suggests a direct casual linkage, flowing from economic growth to fiscal decentralization, the theoretical linkages have not been well developed. Oates (1993) postulated that the proposition in a static setting that fiscal decentralization is efficiency enhancing should have a corresponding proposition in the dynamic setting of economic growth. In principle, policies formulated for the provision of physical and human capital that are sensitive to regional variations in tastes and preferences are likely to be relatively more growth-enhancing than centrally determined policies than ignore these variations. Conversely, decentralization may lead to the underprovision of certain public goods that generate positive spillovers. In this case, decentralization may lead to under-investment and lower rates of economic growth. However, there is no formalized theory that captures the hypothesized relationship between increased fiscal decentralization, increased economic efficiency, physical and human capital, and economic growth.

Davoodi and Zou (1998), Zhang and Zou (1997, 1998), and Davoodi, Xie, and Zou (1999) have argued that the long-run growth rate of per capita output is a function of fiscal decentralization measured by shares of spending by different levels of government, the average tax rate, and the

[51] Oates (1972, 1990, 1991), Bahl and Linn (1992), Prud'homme (1995), and Tanzi (1996, 2000) are among those who have hypothesized that decentralization is a superior good.

expenditure shares of various public expenditures undertaken by each level of government. These studies were among the first to directly link fiscal decentralization and economic growth in a theoretical model. Causality is uni-directional, from fiscal decentralization to economic growth. They postulated that there exists an optimal degree of fiscal decentralization that maximizes economic growth and the optimal degree of fiscal decentralization is dependent upon the relative productivity of each level of government. We see this as a contribution in that we believe that a monotonic relationship does not exist between fiscal decentralization and economic growth, only a growth-maximizing degree of fiscal decentralization. These studies, however, suffer from a common fault, the use of a representative agent model which belies any advantages or disadvantages that may arise from fiscal decentralization (Martinez-Vazquez and McNab, 1998).

Ignoring differences in tastes and preferences is not the only problem with the adoption of a representative agent model. A representative agent model assumes that the preferences of a single individual (the representative agent) proxy for the aggregated preferences of all agents in the economy. In a representative agent model, one makes a policy change and then examines the new equilibrium for the representative agent. However, the use of a representative agent approach may be flawed from a policy perspective (Kirman, 1992). The representative agent approach explicitly assumes that the choice of the representative agent still coincides with the aggregate choice of all the agents in the economy after the policy change. In some instances, the use of a representative agent model can lead to misleading conclusions, specially when policy affects only a subset of individuals in the economy (Kupiec and Sharpe, 1991). But again, more importantly, with respect to fiscal decentralization, the use of a representative agent model explicitly assumes away the most powerful argument for fiscal decentralization, the potential gains in allocative efficiency resulting from the adjustment of tax-expenditure packages by subnational governments to more closely match the heterogenous preferences of their constituents. The results of Davoodi et al. (1995), Davoodi and Zou (1998), and Zhang and Zou (1998) are thus called into question and warrant further examination in a theoretical model that does not place undue restrictions on the preferences of agents in the economy.

More recently, Lin and Liu (2000) examined the effect of fiscal decentralization on economic growth for the case of China. Using a Solow (1956) neoclassical model of economic growth, they postulated that growth in per-capita income is a function of fiscal decentralization, fiscal capacity, physical capital investment, and other factors. The benefit to this approach is that a priori restrictions were not needed for the preferences of agents in the economy, although the use a Cobb-Douglas production function may place significant restrictions on production technology. Lin and Liu (2000) found that fiscal decentralization, as measured by the rate of marginal revenue retention, has had a positive and significant influence on the growth rate of per-capita income, and that, for the case of China, causality is uni-directional, from fiscal decentralization to growth in per-capita income. Curiously, even though they had sufficient data to examine the effect of fiscal decentralization on horizontal fiscal inequalities and on macroeconomic stability, they failed to conduct such an analysis. Also, instead of explicitly examining the effect of fiscal decentralization on technical efficiency, they subsumed this effect into the estimated coefficient for fiscal decentralization on economic growth.

Alesina and Spolaore (1997) and Panizza (1998) examined the determinants of fiscal centralization within the context of a secessionist model. The level of fiscal centralization is determined by a sequential game in which the central government maximizes its budget subject to a no-secession constraint. While economic agents have similar preferences and income, they differ in their tastes for the local public good, allowing the efficiency gains of fiscal centralization to be captured in the model. Panizza (1998) found that fiscal centralization is negatively correlated with economic growth, that is, richer countries tend to be less centralized than relatively poorer countries. This result suggests that causality flows from economic growth to fiscal centralization (decentralization) and mirrors the previous results of Oates (1972, 1993), Bahl and Nath (1986), Davoodi and Zou (1998), among others. However, Panizza's (1998) model assumed that the central and subnational governments operate on the same production frontier, which ignores the possibility of productivity gains (or losses) from fiscal decentralization.

Most of these studies also appear to suffer from two significant problems: (1) the misspecification of the empirical models; and (2) the failure to condition the empirical estimates. Long-term economic growth is a function of many variables including economic freedom and basic legal structure, savings rates, investment behavior, physical and human capital accumulation, technological development, and others (Romer, 1986, 1989; Barro, 1990). The previous studies on the correlation between fiscal decentralization and economic growth, in general, have failed to account for this type of control variables. Of course, the exclusion of some (if not all) of the necessary control variables across countries and/or over time can result in a misspecified model which in turn may lead to the false conclusion that a statistically significant relationship exists between fiscal decentralization and economic growth. Levine and Renelt (1992) singled out this danger. The authors used cross-country time series data to show that the results found in many previous studies of a significant correlation between measures of economic policy and economic growth are fragile. In particular, Levine and Renelt found that the statistical significance for those explanatory variables was lost by small alterations in the set of explanatory variables.[52] This is the fate of a wide array of fiscal-expenditure and trade-policy variables, monetary policy indicators, and political stability indices. The only robust correlations they found with economic growth were for the share of investment in GDP and for the share of international trade in GDP.[53]

Second, only recently have economists attempted to quantify the role of government expenditures on economic growth. The statistical results are far from offering a clear picture of this relationship. Landau (1983), Aschauer (1989), and Barro (1991) each found that an increasing share of central government consumption in GDP is negatively associated with growth in per capita income. On the other hand, Ram (1986), using a cross-country sample of 115 countries, found that government expenditures are positively correlated with economic growth. Devarajan, Swaroop and Zou (1996) examined the impact of the composition of public expenditures on economic growth and noted that while an increase in the share of current central government expenditure has a positive and statistically significant effect on growth, the capital component of public expenditure has a negative impact on per capita growth. The authors concluded that developing country governments may have been allocating too many resources to capital investments at the cost of more productive current expenditures. Other

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52 While Davoodi and Zou (1998) used the Levine-Renelt conditioning variables to test the fragility of the estimate for fiscal decentralization, they did not control for the impact of the external sector. As shown by Feder (1983) and McNab and Moore (1998), the external sector significantly influences the rate of economic development.

53 Woller and Phillips (1998) included the external sector when conditioning the results of their analysis and failed to find a statistically significant relationship between fiscal decentralization and economic growth.

studies have found that public infrastructure spending has a positive significant impact on growth (Aschauer, 1989; Easterly and Rebelo, 1993).

Summarizing this discussion, it appears that there is sufficient grounds in the literature to warrant an investigation into whether a statistically significant direct relationship exists between fiscal decentralization and economic growth. There is no consensus in the literature, however, on whether such a relationship exists, what is the sign of the relationship if it exists, or what is the potential magnitude of the direct relationship between fiscal decentralization and economic growth. What has not been adequately addressed in the literature are the potential indirect effects of fiscal decentralization on economic growth. With this in mind, we now turn to a discussion of the indirect channels through which fiscal decentralization may affect economic growth.

Decentralization and Economic Growth: Indirect Effects. What has been largely ignored in the literature are the indirect channels through which fiscal decentralization may affect economic growth. Given the debate over the impact of fiscal decentralization on economic efficiency, income and interjurisdictional equity, and macroeconomic stability, it is surprising that these indirect channels have not been empirically investigated.

If fiscal decentralization significantly influences economic efficiency, then fiscal decentralization is likely to influence economic growth through changes in economic efficiency. Changes in allocative efficiency may not necessarily maximize economic growth, especially if tastes and preferences significantly diverge from the mixture of public goods that would maximize economic growth (Guess et al., 1997). Changes in allocative efficiency, however, may influence democratic governance, which may in turn influence economic growth. Changes in technical efficiency, however, are likely to significantly influence economic growth as the gains (losses) in technical efficiency allow a society to produce more (less) of the desired mixture of public goods with a given level of resources. Given that we can not measure whether fiscal decentralization improves social welfare, we must focus our attention on the stated goal of technical efficiency.

With respect to income inequality, the theoretical and empirical evidence to date is that corruption results in increased levels of income inequality. Whether increases in income inequality translate into reduced economic growth is still a matter of debate in the literature. Corruption may have considerable, adverse effects on economic growth, largely by reducing private investment (Mauro, 1995, 1996). High and rising levels of corruption may also increase income inequality and poverty by reducing economic growth, the progressivity of the tax system, the level and effectiveness of social spending, and the formation of human capital (Gupta et al., 1998). In general, there appears to be consensus that corruption negatively affects economic growth. Even though some have argued that fiscal decentralization increases opportunities for corruption, the emerging consensus in the literature is that fiscal decentralization may reduce rent-seeking behavior by local government officials (Guess et al., 1997). As programs are decentralized, the visibility of corruption and accountability to those receiving services is increased, thus decreasing the economic and social returns to rent-seeking behavior. If fiscal decentralization reduces corruption, then we should expect that economic growth will also be positively effected.

There is also evidence that income inequality is negatively correlated with economic growth. Countries with lower levels of income inequality have a greater return to human capital relative to countries with greater levels of inequality.[54] Inequality also creates social tensions that may retard economic development. However, most of this research has focused on the impact of income inequality across the population and much less on disparities in resources and income across regions. Attempts at equalizing regional disparities might come at a cost of disparities in the distribution of private resources (Murphy et al., 1995). The question is then whether fiscal decentralization has an effect on income inequality, a question that is open to debate.

Whether fiscal decentralization exacerbates horizontal fiscal imbalances appears to be a question of the design of decentralization and not the effect of decentralization, per se. If, controlling for the design aspect of decentralization, fiscal decentralization does significantly influence horizontal fiscal balances, then it is important to determine whether increases in horizontal fiscal inequities adversely impacts economic growth. We must note that if the increase in disparities comes as resources are reallocated from inefficient to relatively efficient subnational jurisdictions, economic growth may be enhanced at the cost of social welfare. Again, since we unable to measure social welfare, we must rely on growth as a measure of benefit.

If fiscal decentralization significantly impacts macroeconomic stability, then the indirect channel through which fiscal decentralization may affect economic growth is clear. Increases in macroeconomic instability affect economic growth through a variety of mechanisms, to include increased price instability and debt service, higher risk premiums, and greater transaction costs. Given that previous empirical examinations have found that higher rates of inflation retard economic growth (Fischer, 1993), if fiscal

[54] See, for example, Deininger and Squire (1996).

decentralization does result in increased macroeconomic instability, then the indirect effect on economic growth is likely to be negative.

The Tradeoffs Resulting From Fiscal Decentralization

To this point, we have examined each of the potential outcomes of fiscal decentralization in a singular fashion, yet, as noted in the introduction to this section, fiscal decentralization is likely to involve interactive effects between its outcomes and that these effects should be central to the analysis and design of fiscal decentralization policies. Each of these outcomes (economic efficiency, interjurisdictional equality, macroeconomic stability, democratic governance, and economic growth) is complex, and it is likely that fiscal decentralization effects each simultaneously through a number of channels. If this argument holds, then economic analysis and policy discussions regarding fiscal decentralization would have to take into account the simultaneous, interactive influence of fiscal decentralization on economic efficiency, interjurisdictional equality, macroeconomic stability, democratic governance, and economic growth. In short, if the conjecture that fiscal decentralization increases economic efficiency but also fiscal disparities is true, then policy makers will have to weigh not only the singular impact of fiscal decentralization on efficiency and horizontal fiscal disparities, but also the overall effect on economic growth. Only in this manner would policy makers be able to determine the appropriate degree and form of fiscal decentralization.

To date, much of the literature on fiscal decentralization has focused on the singular impact of fiscal decentralization on economic growth and has not examined the potential simultaneity between the outcomes of fiscal decentralization. Guess et al. (1997) noted that the main questions in any case study of fiscal decentralization have to address whether policy interventions that affect the outcomes of fiscal decentralization maximize the probability of gains and minimize the probability of losses associated with fiscal decentralization. Only if fiscal decentralization is examined in multiple dimensions can we effectively ascertain whether or not fiscal decentralization has an overall positive or negative impact on economic growth.

Tanzi (1996) provided an example of the interdependence between the outcomes of fiscal decentralization. He argued that local governments often raise revenue with inefficient taxes, imposing significant welfare costs on the economy and diluting the potential efficiency gains from fiscal decentralization. Furthermore, improper revenue assignment of major tax bases may also exacerbate fiscal imbalances, resulting in increased macroeconomic instability. McLure (1995) countered that this argument is primarily institutional in nature and that proper revenue assignment can alleviate the problems that Tanzi hypothesized would arise though fiscal decentralization. Whether or not Tanzi's argument is correct, it warrants notice in that it highlights the multi-dimensional impact of fiscal decentralization.

We can also observe in the literature that every available measure of corruption is inversely related to per capita income, whereas every measure of bureaucratic efficiency, rule of law, and contract enforceability is positively related to per capita income (Mauro, 1995; Barro, 1996). Alesina (1999) reported simple cross-country correlations for the period 1960-92 between the initial level of economic development, economic growth, and measures of government efficiency. The level of income is strongly correlated with bureaucratic quality, rule of law, and democratic governance. Richer countries tend to have lower levels of corruption, ethnic fractionalization, and political instability.

Political stability and institutional quality are also positively correlated with economic growth. If fiscal decentralization significantly influences government efficiency and corruption, then it is probable that there will be an impact on economic growth.

Tanzi (1998) argued that even if a government is highly concerned about the levels of income inequality it should promote macroeconomic stability as stability is a precursor for economic growth. Economic growth is not only a source of jobs, but also a source of public resources for public sector programs to reduce poverty and inequality. Stability and growth appear to have provided the Chilean government an increasing amount of public resources to alleviate income inequality. If fiscal decentralization promotes macroeconomic stability and in turn economic growth (Huther and Shah, 1996; Shah, 1999), then income inequality may be lessened, which in may further enhance economic growth (Persson and Tabellini, 1994; Birdsall et al., 1995).

In summary, our review of the literature has illustrated the need for a theoretical framework that addresses the potential simultaneity between the outcomes of fiscal decentralization. While advances have been made in linking fiscal decentralization and economic growth, these contributions explicitly assume away the primary rationale for fiscal decentralization, gains in economic efficiency. Other recent contributions have ignored the possibility that different levels of government may operate on different production frontiers. In general, the empirical studies to date have not examined the influence of fiscal decentralization on interjurisdictional and income inequality or macroeconomic stability, and the overall impact of fiscal decentralization has also not been examined empirically. With this in mind, we now turn to the theoretical framework that will guide the empirical analysis of this dissertation.

CHAPTER THREE

A THEORY OF FISCAL DECENTRALIZATION

Introduction

In the previous chapter, we examined the current state of the literature and noted that the potential indirect effects of fiscal decentralization (economic efficiency, interjurisdictional equality in the distribution of public resources, macroeconomic stability, and democratic governance) on economic growth have not been thoroughly examined, nor have the potential tradeoffs between these outcomes of decentralization been quantified. Theoretically, many of the recent studies of the influence of fiscal decentralization on economic growth have explicitly assumed away the allocative efficiency gains from fiscal decentralization through the use of a representative agent model.[55] Empirically, we noted that the more recent studies implicitly assumed uni-directional causality flowing from fiscal decentralization to economic growth, even though the earlier literature exhibited wide consensus that the level of economic development is a significant determinant of the level of fiscal decentralization. We also argued that there

[55] The allocative efficiency argument for fiscal decentralization is based upon the assumption that agents in the economy have heterogenous preferences and that the central government is unable or unwilling to alter the uniform provision of public goods to more closely match the preferences of agents. Increases in allocative efficiency arise if subnational governments are able to alter their tax-expenditure packages to more closely match the preferences of agents. A representative agent model explicitly assumes that preferences are homogenous and thus fundamentally ignores the allocative efficiency rationale for fiscal decentralization.

has been a general failure in the literature to properly condition the estimates of fiscal decentralization. With this in mind, we now turn to the task of developing a theoretical model to investigate the impact of fiscal decentralization on economic efficiency, interjurisdictional equality in the distribution of public resources, macroeconomic stability, democratic governance, and economic growth.

The objective of this chapter is to present a theoretical model for framing the question of what is the impact of fiscal decentralization on its hypothesized outcomes. The rest of this chapter is organized as follows. In the second section of this chapter, we develop the theoretical model that links fiscal decentralization and economic growth without placing undue restrictions on the preferences of agents in the economy. Unlike previous theoretical examinations of fiscal decentralization and economic growth, our theoretical model includes the direct and indirect effects of fiscal decentralization on economic growth. In the third section, we develop a hypotheses framework for examining the influence of fiscal decentralization on economic growth and the potential tradeoffs resulting from fiscal decentralization. We conclude the section and the chapter by specifying the testable hypotheses that form the foundation of the estimation equations that are discussed in Chapter Four and estimated in Chapter Five.

The Objectives of the Theoretical Model

Ideally, a theoretical model of fiscal decentralization should provide a structure that encompasses the potential direct and indirect effects of fiscal decentralization. The theoretical model should allow for the possibility of a direct relationship between fiscal decentralization and economic growth in response to the proposition that the static efficiency effects of fiscal decentralization have a corresponding dynamic effect on economic growth.[56] More importantly, since the direct relationship between fiscal decentralization and economic growth is not one of the conventional arguments for decentralization, the theoretical model should allow for the potential indirect effects of fiscal decentralization on economic growth, that is, decentralization's impact on economic efficiency, the distribution of public resources across subnational jurisdictions, macroeconomic stability, and democratic governance. Including the indirect effects of fiscal decentralization on economic growth allows for the analysis of the potential tradeoffs among the outcomes of fiscal decentralization.[57] Drawing from the literature on economic growth, the theoretical model should also include human capital as an input in the production function. Finally, the theoretical model should not place undue restrictions on the preferences of agents in the economy nor on technology.

As discussed in Chapter Two, the more recent theoretical models of fiscal decentralization have either placed undue restrictions on the preferences of agents in the economy or have failed to include the potential indirect effects of fiscal decentralization on economic growth.[58] More importantly, these models have failed to quantify the potential tradeoffs between the direct and indirect effects of fiscal decentralization.[59] In response to these concerns, we develop a neoclassical model of economic

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[56] See Oates (1993) for a discussion of this proposition.

[57] We note that the terms 'indirect and direct effects of fiscal decentralization' and 'outcomes of fiscal decentralization' are used interchangeably throughout this dissertation as are the terms "economic growth" and "per capita GDP growth."

[58] Davoodi and Zou (1998), Zhang and Zou (1998), and Lin and Liu (2000) are examples of the most recent theoretical models on the relationship between fiscal decentralization and economic growth.

[59] See Gerson (1998) for a survey of the theoretical and empirical literature on the relationship between fiscal policy variables and economic growth.

growth that explicitly includes human capital accumulation and the direct and indirect effects of fiscal decentralization on economic growth. We believe that using the neoclassical growth modeling approach to the question of the impact of fiscal decentralization on economic growth is superior to previous studies employing a representative agent approach in that we do not place a priori restrictions on the preferences of agents in the economy, nor do we place implicit restrictions on technical efficiency at different levels of government. The significant advantage of adopting a neoclassical model of economic growth is that it allows the inclusion of the indirect effects of fiscal decentralization, which allows us to examine the potential tradeoffs between the different objectives of fiscal decentralization.

One of the primary results of the neoclassical growth modeling approach is that a country's per capita growth rate is inversely related to its initial level of per capita income. This result, known as the absolute convergence hypothesis, implies that, in the presence of diminishing returns to scale for all forms of reproducible capital, all countries should, given sufficient time, converge to similar per capita incomes. The absolute convergence hypothesis implies that, all else being equal, countries with higher levels of initial per capita income should grow at a slower rate relative to countries with lower levels of initial per capita income. However, the empirical evidence thus far has not supported the absolute convergence hypothesis in that per capita grow rates do not appear to be significantly influenced by initial levels of per capita income (Barro, 1991, 1996, 1999).

The rejection of the absolute convergence hypothesis may be attributed to the fact that besides differences in per capita income, countries are not equal in that there is a significant amount of variation in economic, as well as social and political conditions, from country to country. These variations imply that each country has its own steady state level of economic growth and the more that a country diverges from its steady state, the faster that country will grow relative to other countries which are closer to their steady state. If we control for variations in fiscal policies, human capital, and other determinants of economic growth, then we should observe that the hypothesis that poor countries grow relatively faster than rich countries is supported by the evidence. This result is commonly known as the conditional convergence hypothesis.[60]

The conditional convergence hypothesis implies that investigations into the determinants of economic growth should control for variations in environment. Failure to control for variables such as fiscal decentralization, democratic institutions, human capital, and other socio-economic factors, may overstate the contribution of other variables in the model to economic growth or the model may fail to adequately explain variations in the different rates of economic growth. Empirically, the omission of these variables is likely to lead to omitted variable bias and may influence our conclusions on the significance, direction, and magnitude of the relationship between fiscal decentralization, its outcomes, and economic growth. With this in mind, we turn to the development of the theoretical model.

The Theoretical Model

Following Mankiw, Romer, and Weil (1992), we employ an augmented Solow (1956) neoclassical model of economic growth that includes the accumulation of human as well as physical capital to examine the influence of fiscal decentralization. We augment the model by explicitly differentiating between public and private capital in the production function. This distinction allows us to investigate the technical efficiency effects of fiscal decentralization on economic growth because we are

[60] See Barro (1991), Barro and Sala-i-Martin (1995), and Barbone and Zalduendo (1996) for a further discussion of this issue.

able to examine whether decentralization has a significant impact on the accumulation of private, public, and human capital. We also augment the model by assuming that the standard term for technological progress can be disaggregated into exogenous technical progress and the direct and indirect effects of fiscal decentralization. This specification, which adheres to the conditional convergence hypothesis, is necessary to properly control for the determinants of economic growth, one of which, the main focus of this dissertation, is fiscal decentralization. We assume a Cobb-Douglas production function for the entire economy[61], so production at time t is given by[62]

$$\begin{gathered} Y(t) = A(t)\, K(t)^{\alpha}\, H(t)^{\beta}\, G(t)^{\psi}\, L(t)^{\theta} \\ \alpha > 0,\ \beta > 0,\ \psi > 0,\ \theta > 0 \\ \alpha + \beta + \psi + \theta \geq 1 \end{gathered} \tag{1}$$

where $Y(t)$ is output, $A(t)$ is the level of technology and other institutional factors, including fiscal decentralization, $L(t)$ is labor force participation, and $K(t)$, $H(t)$, and $G(t)$ are the stocks of private, human, and public capital at time t, respectively. We define $A(t)$ as the product of the level of technology and other institutional factors at time t or

$$A(t) = T(t)\, D(t)\, MS(t)\, IJ(t)\, Gov(t) \tag{2}$$

where T is the level of technology, D is the level of fiscal decentralization, MS is the level of macroeconomic stability, IJ is the level of interjurisdictional equality in the distribution of public

[61] The use of a Cobb-Douglas functional form is fairly common in the economic growth literature. See Romer (1986), Barro (1990), Mankiw et al. (1992), Tondl (1999), and Lin and Liu (2000), among others.

[62] See Appendix A for a complete derivation of the theoretical model.

resources, and *Gov* is the level of democratic governance. We further assume that L and T grow exogenously at rates n and g, respectively.

With respect to reproducible capital, the remaining question is whether to neglect depreciation for simplicity, assume a uniform rate of depreciation, or to allow different rates of depreciation for each type of reproducible capital. Neglecting depreciation implies that the stock of reproducible capital at time t is the result of investment from $t = -\infty$ to t. The benefit to this approach is theoretical simplicity, especially in those cases where the main focus is not on the impact of depreciation on the rate of accumulation of reproducible capital.[63] The second approach to the question of depreciation is to assume that the rate of depreciation is uniform across all types of reproducible capital. This approach combines the benefit of theoretical simplicity with the explicit inclusion of depreciation in the theoretical model. However, this approach may place an undue restriction on the depreciation of different forms of reproducible capital.[64] The third approach is to have distinct production functions and depreciation rates for the different forms of reproducible capital. While being more flexible with respect to the depreciation of capital over time, this approach adds complexity to the model, complexity which may be unwarranted if the main focus is not the influence of reproducible capital on output.[65] Given that our theoretical model is an extension of the model first developed by Solow (1956) and refined by Mankiw et al. (1992), we believe it is appropriate at this time to assume that the same production function

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[63] See Tondl (1999) for an example of this approach.

[64] See Mankiw et al. (1992) for a example of this approach.

[65] See Lucas (1988) for a discussion of this approach with separate production functions for private and human capital.

applies to private, public, and human capital, and that private, public, and human capital depreciate at the same uniform rate δ.

With respect to the other factors included in Equation (2), we assume that these factors (macroeconomic stability, interjurisdictional equality in the distribution of public resources, and democratic governance) are functions of, among other things, fiscal decentralization or

$$\begin{aligned} MS(t) &= g(D(t), X^1(t)) \\ IJ(t) &= h(D(t), X^2(t)) \\ GOV(t) &= i(D(t), X^3(t)) \end{aligned} \qquad \textbf{(3)}$$

where $X^i(t)$ (i = 1,..,3) are vectors of other exogenous variables explaining the behavior of the three variables of interest. For simplicity, we assume that decentralization is uncorrelated with the $X^i(t)$.

Equation (1) states that, at any time, the output of an economy is dependent upon the stocks of private, public, and human capital, the rate of labor force participation, the stock of technology, and the direct and indirect effects of fiscal decentralization. Short-term output can only increase if the level or quality of inputs increase, the stock of technology increases, or, assuming the joint effect of fiscal decentralization is positive, the level of decentralization increases.[66] Conversely, short-run output can only decrease if the level or quality of inputs decrease, the stock of technology decreases, or assuming the joint effect of fiscal decentralization is negative, the level of decentralization increases.[67] Steady

[66] Decentralization, of course, is bounded by 0 and 1.

[67] We note that there are many events (sustained drought, depressed (or enhanced) prices for natural resources) that are not explicitly included in the theoretical model. We assume, for the sake of analytical simplicity, that these effects are reflected by changes in the quality of quantity of inputs (labor, reproducible capital) or the stock of technology.

state increases in output can only arise if there are permanent increases in inputs or changes in the quality of inputs. Even if there are permanent increases in inputs, steady state increases in output may not occur if the joint effect of fiscal decentralization is negative and the output effect of fiscal decentralization is greater than the increase in output that, all else being equal, would be associated with the permanent increase in inputs. On the other hand, increases in the joint effect of fiscal decentralization could also induce increases in output, all else remaining equal, or magnify the increase resulting from an increase in the level or quality of inputs, under the assumption that output is positively correlated with the joint effect of decentralization.

The growth model specified in Equation (1) can be either a Solow-augmented neoclassical growth model with constant returns to scale for all production factors ($\alpha + \beta + \psi + \theta = 1$), or an endogenous growth model with increasing returns to scale for all production factors ($\alpha + \beta + \psi + \theta > 1$).[68] Also, if any combination of the reproducible capital inputs exhibits constant returns to scale ($\alpha + \beta =1$, $\beta + \psi =1$, $\alpha + \psi = 1$), then Equation (1) would similarly be characterized as an endogenous growth model. If we assume, as do Mankiw et al. (1992), that physical and human capital are subject to decreasing returns to scale, then the economy, over the long-run, will tend to constant private capital-labor, human capital-labor, and public capital-labor ratios.[69] Once steady state output is achieved, additional increases in output can only be achieved through increases in capital productivity

[68] While changes in resource endowments (the discovery of new oil resources or the cure for AIDS) may affects short-term capital-labor ratios, these changes would not affect the steady state capital-labor ratios unless these changes affect capital productivity.

[69] Senhadji (1999) noted that a large part of the empirical growth literature supports the assumption of decreasing returns to capital.

or, under the assumption that the joint effect of decentralization is positive, increases the level of decentralization.[70]

With respect to the impact of fiscal decentralization, we note that decentralization may affect output through two channels, a potential direct effect on output, and a series of potential indirect effects. Taking the first-order derivative of Equation (1) with respect to fiscal decentralization, we obtain

$$\frac{dY(t)}{dD(t)} = A(t)\left[\frac{1}{D(t)} + \frac{MS_D}{MS(t)} + \frac{IJ_D}{IJ(t)} + \frac{Gov_D}{Gov(t)}\right]$$
$$Y(t)\left[\alpha\frac{K_D}{K(t)} + \beta\frac{H_D}{H(t)} + \psi\frac{G_D}{G(t)} + \theta\frac{L_D}{L(t)}\right] \tag{4}$$

where the subscript refers to the first-order partial derivative of the variable with respect to fiscal decentralization. Given that *A(t)* and *D(t)* are positive and that *D(t)* is bounded between zero (complete centralization) and one (complete decentralization), the direct effect of fiscal decentralization in Equation (4) is to, in effect, magnify the influence of *A(t)* on output. Given that *D(t)* is bounded, the direct effect of decentralization is also bounded at the lower end at *A(t).* As the level of decentralization declines, the direct effect of *D(t)* on *Y(t)* increases, with the upper limit of the direct effect being undefined in the event that the system is completely centralized.

With respect to the indirect effect of fiscal decentralization on output through its potential influence on macroeconomic stability, the derivative of macroeconomic stability with respect to fiscal

[70] As noted by Gerson (1998), policies that lead to a permanent increase in the steady state capital-labor ratio cannot lead to long-run per capita growth, unless *A* is steadily increasing. He argued, however, that since the convergence to the new steady state may take years to occur, fiscal policy can still lead to higher output growth rates for a significant period of time, even though the neoclassical model might imply that these policies would affect only the level of output and not its long-run growth rate.

decentralization is weighted by the level of macroeconomic stability. As *MS(t)* approaches zero (representing increased macroeconomic stability), the indirect effect of fiscal decentralization on output through macroeconomic stability increases. Conversely, as *MS(t)* increases in absolute terms (representing decreased macroeconomic stability), the indirect effect of decentralization on output through macroeconomic stability decreases. As with *D(t)*, *MS(t)* can be considered a bounded variable, although the bounds of *MS(t)* can only be represented as a finite negative number (representing hyperdeflation) and a finite positive number (representing hyperinflation).

We now turn to the potential impact of fiscal decentralization on the distribution of public resources and, in turn, on output. As with the impact of decentralization on macroeconomic stability, the first-order derivative of *IJ(t)* with respect to *D(t)* is weighted by *IJ(t).* However, unlike *MS(t)*, *IJ(t)* is positive and bounded by zero (complete equality in the distribution of resources) and one (complete inequality in the distribution of resources). As the level of equality in the distribution of public resources among subnational jurisdictions decreases (*IJ(t)* approaches 1), the impact of fiscal decentralization on output through *IJ(t)* approaches the value of the first-order derivative of *IJ(t)* with respect to *D(t).* Conversely, as the system becomes more equitable in the distribution of public resources across subnational jurisdictions (*IJ(t)* approaches 0), the potential influence of decentralization through the interjurisdictional equality channel increases.

Democratic governance is the final term in *A(t)* and is measured by an index of economic freedom, rule of law, and other subjective indicators of the prevalence of democratic governance in the country in question.[71] *Gov(t)* is positive and bounded between 0 and 1, with the upper bound representing a country based upon democratic governance and the rule of law (eg. Switzerland) and the lower bound representing a country with the complete absence of democratic governance (eg. Noth Korea). As the level of democratic governance declines (*Govt(t)* approaches the lower bound), the potential influence of fiscal decentralization through democratic governance also increases. Conversely, the level of democratic governance increases (approaches 1), the influence of the fiscal decentralization on output through democratic governance decreases.

Turning to the physical inputs in the production function, we note that the Equation (4) suggests that fiscal decentralization may also affect output through a series of indirect effects on the inputs in the production function. Given that fiscal decentralization results in the reallocation of resources from one level of government to another, it is plausible that decentralization may affect output through its influence on public capital. Decentralization may increase rate of accumulation of public capital, and thus economic growth along the convergence path to the balanced-growth steady state, though a more efficient allocation of resources than would otherwise occur in a more centralized system of governance. Local governments may respond more effectively to the needs of their constituents, allocating resources to basic infrastructure, education, and health goods and services that have been shown to increase private and human capital accumulation, and output, over time. Conversely, if decentralization results in local capture, increased rent-seeking activities by local government officials, or merely the poor allocation of investment resources due to the lack on institutional capacity, it is entirely probable that

[71] Using data from Freedom House's *Freedom in the World* (2000) and following Dailami (2000), we construct a composite index of democratic governance based on the measures of political rights and civil liberties. We discuss the development of the composite index in the next section.

decentralization may decrease the accumulation of public capital and, all else being equal, lead to lower rates of economic growth along the convergence path to the steady state. Decentralization may also create incentives for local governments to move away from the production of public goods that generate large spillovers. If the first-order derivative of *G(t)* with respect to *D(t)* is positive, then increases in the level of fiscal decentralization are likely to positively influence output, though the output effect is weighted by the level of *G(t).* As the level of *G(t)* increases, the output effect of *D(t)* through *G(t)* declines, an illustration of diminishing marginal returns to fiscal decentralization.

With respect to the other physical inputs in the production function, there is a paucity of evidence that fiscal decentralization may influence these inputs and, in turn, output. We could assume a priori that the first-order derivatives of private capital, human capital, and labor force participation are equal to zero given that these effects are not discussed in the literature as one of the potential effects of fiscal decentralization. However, the first-order derivatives for these inputs are a result of the specification of the neoclassical production function in Equation (1) and these inputs have also been shown to significantly and robustly influence the level of output over time. To exclude these variables at this juncture without determining whether they are significantly influenced by fiscal decentralization may introduce specification bias into the empirical models and may produce inconsistent estimates. We believe that it is best to empirically determine the significance, if any, of the relationship between fiscal decentralization and these inputs rather than imposing an a priori restriction on the theoretical model that the first-order derivatives of these inputs with respect to decentralization are equal to zero.

To summarize this discussion, we can multiply Equation (4) by *D(t) / D(t)* and reorganize terms to obtain

$$e_{Y,D} = A(t)\,[\,1 + e_{MK,D} + e_{IJ,D} + e_{GOV,D}\,][\,\alpha\, e_{K,D} + \beta\, e_{H,D} + \psi\, e_{G,D} + \theta\, e_{L,D}\,] \quad (5)$$

where *e* refers to the elasticity of the first variable in subscripts with respect to fiscal decentralization. As illustrated in Equation (5), the elasticity of output with respect to fiscal decentralization is dependent upon the interaction between the indirect effects of decentralization and the sign and magnitude of the output elasticity term cannot be determined a priori. We can state that as the level of decentralization increases to its upper limit of 1, the individual elasticities in Equation (5) increase, but without prior knowledge as to the sign of these elasticities, we can not state whether the overall effect is to increase or decrease the elasticity of output with respect to decentralization. Conversely, as the level of decentralization declines to its lower limit of 0, the individual elasticities in Equation (5) should decrease, but again, without knowledge as to the sign or magnitude of these elasticities, we can not determine with certainty the effect on output elasticity.

To determine the influence of fiscal decentralization on economic growth, we must first determine the steady state levels of the physical inputs in the production function. Let i_k, i_h, and i_g be the fractions of output invested in private, human, and public capital, respectively, and $k(t) = K(t) / L(t)$, $h = H(t) / L(t)$, and $g(t) = G(t) / L(t)$ be the stocks of private, human, and public capital per unit of labor. Following Mankiw et al. (1992), we assume that the same production function applies to all forms of reproducible capital and consumption so that one unit of capital can be assumed to be costlessly transformed into one unit of consumption and vice versa.[72] Recalling that labor force

[72] See Lucas (1988) for an alternative specification with unique production functions for each of the capital inputs.

participation (*L)* and technology (*T)* are assumed to grow exogenously at rates *n* and *g* and that capital depreciation is uniform at rate δ, the growth of output over time is dictated by

$$
\begin{aligned}
\dot{k}(t) &= i_k y(t) - (n + g + \delta) k(t) \\
\dot{h}(t) &= i_h y(t) - (n + g + \delta) h(t) \\
\dot{g}(t) &= i_g y(t) - (n + g + \delta) g(t)
\end{aligned}
\tag{6}
$$

Under the assumption of decreasing marginal returns to all forms of capital and that no combination of capital inputs exhibits constant marginal returns, (6) implies that the economy converges to the steady state as defined by the steady state stock of private capital

$$k^{*}(t) = \left[\frac{i_k^{1-\beta-\psi}\, i_h^{\beta}\, i_g^{\psi}}{n + g + \delta} \right]^{\frac{1}{1-\alpha-\beta-\psi}} \tag{7}$$

the steady state stock of human capital,

$$h^{*}(t) = \left[\frac{i_h^{1-\alpha-\psi}\, i_k^{\alpha}\, i_g^{\psi}}{n + g + \delta} \right]^{\frac{1}{1-\alpha-\beta-\psi}} \tag{8}$$

and the steady state stock of public capital

$$g^{*}(t) = \left[\frac{i_g^{1-\alpha-\beta}\, i_k^{\alpha}\, i_h^{\beta}}{n + g + \delta} \right]^{\frac{1}{1-\alpha-\beta-\psi}} \tag{9}$$

Substituting (7), (8), and (9) into the production function yields

$$y^{*}(t) = A(t)\,k^{*}(t)\left[\frac{\dot{i}_k^{1-\beta-\psi}\,\dot{i}_h^{\beta}\,\dot{i}_g^{\psi}}{n+g+\delta}\right]^{\frac{\alpha}{1-\alpha-\beta-\psi}}\left[\frac{\dot{i}_h^{1-\alpha-\psi}\,\dot{i}_k^{\alpha}\,\dot{i}_g^{\psi}}{n+g+\delta}\right]^{\frac{\beta}{1-\alpha-\beta-\psi}}\left[\frac{\dot{i}_g^{1-\alpha-\beta}\,\dot{i}_k^{\alpha}\,\dot{i}_h^{\beta}}{n+g+\delta}\right]^{\frac{1}{1-\alpha-\beta-\psi}} \tag{10}$$

Expanding *A(t)* and taking the natural logarithm of (10) yields

$$\begin{aligned} \ln y^{*}(t) &= \ln T(t) + \ln D(t) + \ln MS(t) + \ln IJ(t) + \ln Gov(t) \\ &\quad - \frac{\alpha+\beta+\psi}{1-\alpha+\beta+\psi}\ln(n+g+\delta) + \frac{\alpha}{1-\alpha+\beta+\psi}\ln i_k \\ &\quad + \frac{\beta}{1-\alpha+\beta+\psi}\ln i_h + \frac{\psi}{1-\alpha+\beta+\psi}\ln i_g \end{aligned} \tag{11}$$

Equation (11) illustrates that steady state per capita output is dependent upon the accumulation of reproducible capital, population growth, the stock of technology, and the direct and indirect effects of fiscal decentralization. To complete the model, we need to examine how per capita output grows over time. Following Mankiw et al. (1992), let $y^{*}(t)$ be per capita steady state output and $y(t)$ be actual per capita output at time t. We can then take the first-order derivative of (11) with respect to t to determine the speed of convergence to steady state per capita income or

$$\frac{d\ln y(t)}{dt} = \lambda\,(\ln y^{*}(t) - \ln y(t)) \tag{12}$$

where $\lambda = (n + g + \delta)(1 - \alpha - \beta - \psi)$. Equation (12) illustrates the conditional convergence hypothesis, that the deviation from a country's steady state per capita income level and a country's per capita growth rate in income are positively related. Let *y(0)* be the initial level of per capita income, so that (12) becomes

$$\ln y(t) = (1 - e^{-\lambda t}) \ln y^{*}(t) + e^{-\lambda t} \ln y(0) \tag{13}$$

Subtracting *y(0)* from both sides of (13)

$$\dot{y} = \ln y(t) - \ln y(0) = (1 - e^{-\lambda t}) \ln y^{*}(t) + (1 - e^{-\lambda t}) \ln y(0) \tag{14}$$

and substituting (11) into (14) yields the expression for the change in per capita output over time

$$\begin{aligned} \dot{y} = \; & (1 - e^{\lambda t}) [\ln D(t) + \ln MS(t) + \ln IJ(t) + \ln Gov(t) \\ & + \frac{\alpha + \beta + \psi}{1 - \alpha + \beta + \psi} \ln (n + g + \delta) + \frac{\alpha}{1 - \alpha + \beta + \psi} \ln i_k \\ & + \frac{\beta}{1 - \alpha + \beta + \psi} \ln i_h + \frac{\psi}{1 - \alpha + \beta + \psi} \ln i_g - \ln y(0)] \end{aligned} \tag{15}$$

economic growth, as illustrated in (15), is a function of the determinants of the steady state and the initial level of per capita output. Equation (15) has the advantage over previous theoretical specifications of the impact of fiscal decentralization on economic growth in that (15) explicitly takes into account out-of-steady-state dynamics. Equation (15) also illustrates the difference between the bounded institutional factors in the production function and the physical inputs in the production function. The institutional factors directly influence economic growth while the physical inputs are weighted by the ratio of their output share to labor’s share of output.

A standard problem in the neoclassical literature arises with the specification of (15) in that if countries have permanent differences in technology, then these differences would enter as part of the error term and be positively correlated with initial per capita output. Permanent variations in technology could bias the estimated coefficient on initial per capita output toward zero and also might bias the other estimated coefficients. While Mankiw et al. (1992) did not find evidence to support the contention that countries have permanent differences in their production technology, we must be aware of such a possibility. However, if initial technology were not heterogenous, then we should observe that countries with similar levels of fiscal decentralization and rates of capital accumulation and population growth, should converge in income over time.

A similar problem may arise in the specification of (15) in that while countries may not have permanent variations in technology, they may have permanent variations in their institutional factors, including the level of fiscal decentralization. As with permanent variations in technology, permanent variations in the institutional conditions, would enter as part of the error term and would also be positively correlated with initial income. We will need to determine whether these fixed effects are significant and whether we should control for them in the estimation of the influence of fiscal decentralization economic growth. We will return to this issue in Chapter Five.

The Hypotheses Framework

We now turn to the task of developing the empirical hypotheses that will be tested in Chapter Five. In this section, we first develop the testable hypotheses with respect to the indirect effects of fiscal decentralization on economic growth before turning to the question of the direct and overall impact of fiscal decentralization on economic growth. We then examine the potential policy tradeoffs associated with fiscal decentralization and discuss the framework for examining the magnitude of these tradeoffs.

Fiscal Decentralization and Economic Efficiency

We must first note that it is very significant that neither of the two potential economic efficiency effects of decentralization are recorded in the national income accounts. Changes in allocative efficiency (resulting from the ability to match the heterogeneous preferences of taxpayers) translate into increased (or decreased) individual welfare. In general, these changes in consumer welfare are not reported anywhere, including the national income accounts. In fact, identical public expenditures with different levels of allocative efficiency are recorded the same in the income accounts: by the level of expenditures at the national or subnational level. Similarly, equal expenditure programs with very different levels of technical efficiency provide the same reading in the national income and product accounts.

Second, if fiscal decentralization leads to changes in allocative efficiency, the casual relationship between fiscal decentralization and economic growth is much less clear than with the relationship between fiscal decentralization, technical efficiency, and economic growth. Given that the changes in allocative efficiency resulting from fiscal decentralization are not directly accounted for in the conventional measures of output and economic growth, we would require information on input and output prices to examine the question of whether fiscal decentralization induces gains in allocative efficiency. Given the paucity of information on input and output prices for developing and transitional economies, we must forgo examination of this question at this time.

Whether or not fiscal decentralization induces gains in technical efficiency is unclear. If citizens are able to migrate from one subnational jurisdiction to another in response to the tax-expenditure offers of jurisdictions, then subnational governments may be forced to become more competitive over time, resulting in increased technical efficiency and innovation in the provision of public goods and services.

If subnational governments operate on a higher technical production frontier, then a reallocation of resources away from the center to subnational governments may lead to higher quality and/or quantity output. If this hypothesis cannot be rejected then, all else being equal, the accumulation of reproducible capital should be higher in relatively more decentralized countries. Conversely, if subnational governments operate on a lower technical production frontier or if citizens are unable to effectively voice their preferences, if their mobility is constrained, or if subnational governments lack the institutional capacity to provide local public goods and services, decentralization would lower the accumulation of reproducible capital over time.

This being said, we can examine the direct technical efficiency effects of fiscal decentralization by noting that Equation (4) illustrates that the change in output resulting from a change in the level of fiscal decentralization is a function of decentralization's impact on the accumulation of private, public, and human capital. Controlling for other factors, we should observe that a change in the level of fiscal decentralization $(D(t) - D(t-1)) \neq 0$ significantly influences the accumulation of private, public, and human capital. More specifically,

Hypothesis One: All else being equal, a change in the level of fiscal decentralization $(D_t - D_{t-1}) \neq 0$ may lead to a change in the accumulation of per capita private capital investment as measured by per capita gross domestic fixed investment for the private sector $(K_t - K_{t-1}) \neq 0$.

Hypothesis Two: All else being equal, a change in the level of fiscal decentralization $(D_t - D_{t-1}) \neq 0$ may lead to a change in the accumulation of per capita public capital investment as measured by per capita gross domestic fixed investment for the public sector $(G_t - G_{t-1}) \neq 0$.

Hypothesis Three: All else being equal, a change in the level of fiscal decentralization $(D_t - D_{t-1}) \neq 0$ may lead to a change in human capital stock as measured by infant mortality $(H_t - H_{t-1}) \neq 0$.

Fiscal Decentralization and Macroeconomic Stability

If fiscal decentralization significantly influences macroeconomic stability, the impact on economic growth is clear in that the empirical evidence in the literature suggests that macroeconomic stability has a positive and significant influence on economic growth. A priori, there appears to be a general consensus in the literature that poorly designed or implemented decentralization policies can create incentives for subnational governments to engage in fiscally irresponsible and unsustainable expenditure policies. Decentralization also reduces the tax and expenditure scope available to the central government for use in its stabilization function and may divert scarce resources from projects at the national level that are growth-enhancing. However, if subnational governments are more able to more effectively respond to regional variations in aggregate demand and supply shocks, then we may observe that fiscal decentralization may result in increased macroeconomic stability.[73] Controlling for other determinants of macroeconomic stability, we should observe that a permanent change in the level of fiscal decentralization influences the level of macroeconomic stability.

[73] Spahn (1997) argued that economic shocks are not symmetrically distributed across subnational governments and that subnational governments are thus better positioned to tailor their tax-expenditure packages to macroeconomic disturbances.

Hypothesis Four: All else being equal, a change in the level of fiscal decentralization $(D_t - D_{t-1}) \neq 0$ may lead to a change in the level of macroeconomic stability as measured by the price level $(MS_t - MS_{t-1}) \neq 0$.

Fiscal Decentralization and the Distribution of Resources

One of the primary arguments against fiscal decentralization in developing and transitional economies is that decentralization exacerbates existing inequalities in the distribution of public resources across subnational jurisdictions. As with macroeconomic stability, there appears to be an a priori consensus in the literature that poorly designed or implemented fiscal decentralization programs can lead to a concentration of public resources in small number of politically influential or resource rich jurisdictions. Unlike macroeconomic stability, however, there does not appear to be a consensus whether increased horizontal fiscal disparities reduce economic growth. If the increased disparities are a result of the reallocation of public resources to more efficient uses, then it is possible that decentralization may induce increased disparities which in turn result in higher economic growth. Given the consensus in the literature, we would expect a priori that fiscal decentralization positively and significantly influences horizontal fiscal disparities.

A problem does exist in testing this hypothesis in that a lack of data on the distribution of public resources across subnational governments, over time, and across countries, prevents us from empirically examining the question of whether fiscal decentralization increases horizontal fiscal disparities and whether this has a significant influence on economic growth. Unfortunately, the available data only provides aggregate measures of revenues and expenditures at each level of government and we must leave the task of constructing a database of cross-country horizontal fiscal disparities to future research.

Given the lack of information on horizontal fiscal disparities, we will use data on income inequality across the entire population, as measured by the Gini coefficient, as a proxy for horizontal fiscal disparities. We readily acknowledge that the Gini coefficient is an imperfect proxy for the distribution of resources across subnational jurisdictions and that caution must be exercised in specifying the empirical model and interpreting the results. We must also make a caveat with respect to the estimation the interjurisdictional equality hypothesis with interpersonal income inequality data. The available Gini coefficient data are not of sufficient quantity for inclusion in the annual panel data set that is used in Chapter Five to test the other hypotheses in this section. Given the limited nature of the data, we will only be able to test this hypothesis using a sub-sample of countries from the annual panel data set and for a limited number of time periods. This being said, the fifth testable hypothesis is

Hypothesis Five: All else being equal, a change in the level of fiscal decentralization $(D_t - D_{t-1}) \neq 0$ may lead to a change in the level of interjurisdictional fiscal equality as measured by the Gini coefficient $(IJ_t - IJ_{t-1}) \neq 0$.

Fiscal Decentralization and Democratic Governance

One persistent argument in the literature has been that developing and transitional countries may lack sufficient institutional capacity to realize the potential gains from fiscal decentralization. Subnational governments in developing and transitional countries may lack the administrative capacity to provide public services or the ability (or willingness) to respond to the needs of their constituents. Democratic institutions may be weak or non-existent, eliminating the channel by which constituents legally influence the operations of their governments. Decentralization, it is argued, only increases opportunities for rent-seeking behavior in these environments and actually harms public service provision. Only when sufficient development has occurred can the gains from fiscal decentralization be realized.

On the other hand, decentralization has been seen as a method of breaking the grip of central governments and fostering the development democratic and other social institutions. Decentralization increases the need for transparent and stable relations across and between levels of government and exerts a positive influence on the development of institutions in developing and transitional countries. By fostering the emergence and strengthening of democratic institutions, fiscal decentralization reduces opportunities for malfeasance and misallocation of public resources. Resources that would otherwise be diverted are now available for public good provision and investment, enhancing economic growth over time.

The measurement of "democracy" or "democratic governance" is a task outside the scope of this dissertation and we will rely on an accepted measure of democratic governance for our analysis of the impact of fiscal decentralization. The Freedom House is an internationally recognized, non-partisan, research organization committed to promoting democratic governance and the rule of law. The 2000 edition of *Freedom in the World* contains annual assessments from 1973 on civil and political liberties for over 150 countries. The survey rates each country on a seven-point scale for both political rights and civil liberties, with 1 representing the most free and 7 the least free. Following Dailami (2000), we construct a composite index of democratic governance based on the Freedom House measures of political rights and civil liberties, where the composite index is equal to:

$$\text{Democracy} = (14 - \text{civil rights} - \text{political rights}) / 12$$

such that the range of the index is from 0 to 1, with 0 indicating a complete absence of democratic governance, and 1 indicating a fully developed system of democratic governance. Using this index, we should observe that a permanent change in the level of fiscal decentralization induces a change in the level of democratic governance, or

Hypothesis Six: All else being equal, a change in the level of fiscal decentralization $(D_t - D_{t-1}) \neq 0$ may lead to a change in the level of democratic governance as measured by the composite index of democratic governance $(Gov_t - Gov_{t-1}) \neq 0$.

Fiscal Decentralization and Economic Growth

We now turn to the question of the relationship between fiscal decentralization and economic growth. As illustrated in Equation (15), fiscal decentralization has a direct relationship with economic growth, and a series of indirect effects that arise from the direct relationship between fiscal decentralization technical efficiency, horizontal fiscal disparities, macroeconomic stability, and democratic governance. From (15), all else being equal, a permanent increase in the level of decentralization should significantly influence per capita income growth.

Hypothesis Seven: All else being equal, a change in the level of fiscal decentralization $(D_t - D_{t-1}) \neq 0$ should lead to a change in per capita economic growth as measured by the change in per capita Gross Domestic Product $(y_t - y_{t-1}) \neq 0$.

The Tradeoffs of Fiscal Decentralization

The remaining question focuses on the tradeoffs between the direct and indirect effects of fiscal decentralization. Policymakers are generally cognizant of the potential tradeoffs involved when deciding on the scope and magnitude of a decentralization program. It could be that more decentralization would result in increased horizontal fiscal disparities or increased macroeconomic instability. What they do not know but what could be very useful to them is the quantitative relations in these tradeoffs, for example, for a particular change in the level of decentralization, what is the resulting effect on macroeconomic stability, horizontal fiscal equities, democratic governance, and growth? If these hypothesized tradeoffs exist, policymakers may find the tradeoffs unacceptable for a given increase (or decrease) in the level of decentralization. Following Dollar and Kraay (2000), we can use the estimation results from Equation (15) to calculate the average long-term growth impacts of changes in the outcomes of fiscal decentralization. By calculating a one standard deviation change in fiscal decentralization and then multiplying the one standard deviation by the estimated coefficient from Equation (15) for each variable, we can estimate the static long-term growth effect of a one standard deviation change in each variable. These results will then allow us to quantify the tradeoffs between the outcomes of fiscal decentralization.

In summary, we use the seven testable hypotheses developed in this section to examine the effect of fiscal decentralization on economic efficiency, interpersonal income inequality, macroeconomic stability, democratic governance, and economic growth. Given the uncertainty on whether fiscal decentralization positively or negatively influences these outcomes, we have left this determination to the empirical analysis. We now turn to the development of the empirical framework within which we will test the hypotheses developed in this section.

CHAPTER FOUR

EMPIRICAL METHODOLOGY

Introduction

In Chapter Three, we developed a neoclassical model of economic growth that not only included the hypothesized direct linkage between fiscal decentralization and economic growth, but also, for the first time in the literature, developed the indirect linkages between fiscal decentralization and economic growth. From this theoretical model, we developed seven testable hypotheses on the influence of fiscal decentralization and the framework within which we can quantify the potential tradeoffs between the outcomes of fiscal decentralization. We now turn to the task of developing an empirical framework within which we can empirically investigate the influence of fiscal decentralization on technical efficiency, interjurisdictional equality in the distribution of public resources, macroeconomic stability, democratic governance, and economic growth.

The objective of this chapter is to present an empirical methodology for estimating what is the impact of fiscal decentralization. In the second section, we discuss the measurement of fiscal decentralization and the data sources that are used for the estimations reported in Chapter Five. We also define and discuss the variables that are used to test the hypotheses developed in Chapter Three of this dissertation. In the third section, we develop the empirical framework and specify the estimation equations that are used in Chapter Five to test the seven hypotheses on the influence of fiscal decentralization. We first discuss the two-way error components model for unbalanced panels and the tradeoffs involved in using a fixed effects model rather than a random effects model to estimate the influence of fiscal decentralization. We conclude the section and chapter with the specification of the estimation equations that we will use in Chapter Five to estimate the impact of fiscal decentralization and the potential tradeoffs among the outcomes of fiscal decentralization.

Data Sources

In this section, we examine the measurement of fiscal decentralization, the data sources that are used to develop the panel data set for estimation of the testable hypotheses, and the variables used in the specification of the estimation equations in third section of this chapter. We noted in Chapter Two that fiscal decentralization is a multi-dimensional process that has been typically measured in one dimension due to the lack of information on the autonomy of subnational governments. As we discuss below, this issue remains an unsolved problem due to a wide range of factors. We then turn to a discussion of the data sources that are used to develop the dependent and independent variables used in the specification and estimation of the hypotheses developed in Chapter Three. We conclude with a discussion of the main variables of interest that are used in the third section for the specification of the estimation equations.

The Measurement of Fiscal Decentralization

Ideally, we would wish to construct a panel data set of measures of fiscal decentralization that would effectively quantify the activities of subnational governments that result from independent decision making.[74] In this context, we would classify those revenues and expenditures that are under the effective control of the central government as central government activities, regardless at which level of government these revenues or expenditures occurred. Likewise, activities that were under the control of subnational governments, even if they were funded by the central government, would be classified as a subnational government activity. Constructing such a panel data set would require information on the types of grants and transfers received by subnational governments; the structure of the tax system to determine whether and how revenues were shared and the discretion of subnational governments to levy and collect taxes; and the discretion granted to subnational governments to expend resources to meet the needs of their constituents. Ideally, we would also include information on the political autonomy of subnational governments in the fiscal decentralization data set.

Unfortunately, we can not readily address these issues with the available data. The International Monetary fund established the Government Financial Statistics (GFS) system with the objective of providing a conceptual and accounting framework for the evaluation of the analysis of the general government sector of the economy. The GFS system is designed to provide statistics that enable policy makers and analysts to study the development of general government revenues and expenditures over time. As the GFS system is harmonized with other macroeconomic statistical systems, data from the GFS system can be combined with other macroeconomic data for the evaluation of general government performance. Furthermore, the establishment of international standards in the GFS system permits the use of GFS data in cross-country analysis of government operations. The

[74] See Oates (1972) and Guess et al. (1997) for a further discussion of this issue.

Government Finance Statistics Annual Yearbook (1999) is the primary data source for public sector revenues and expenditures and contains information on central, regional, and local government, where appropriate, revenues and expenditures.[75]

While the GFS system reports information on grants and transfers between the various levels of government, it does not contain information on whether the grants and transfers are under the control of the central or recipient level of government or if the grants are conditional, block, or lump-sum. The GFS system also does not report information on the nature of transfers. Cross-sectional and time-series data on the number and size of subnational governments is sketchy at best for developed countries and virtually non-existent for developing and transitional countries, except in those cases where technical assistance providers have conducted surveys of subnational governments. It is this lack of information that has led to the use of a measure of fiscal decentralization that is typically constructed as a ratio of subnational government expenditures (revenues) to general government expenditures (revenues).[76]

The problem with defining decentralization as the ratio of subnational government revenues (expenditures) to general government revenues (expenditures) is that we do not know to what extent subnational governments have autonomy in their decisions about expenditure composition and the production and delivery of public goods and services. We also do not have information on whether subnational governments have discretion on raising revenues. Qualitative measures of these revenue

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[75] For an overview of the GFS, see http://www.imf.org/external/pubs/ft/gfs/manual/index.htm.

[76] General government revenues (expenditures) are equal to the revenues (expenditures) of the consolidated central government (budgetary central government, extra-budgetary funds, and social security) and the revenues (expenditures) of subnational governments.

and expenditure decisions would be needed for the construction of a measure of decentralization that encompassed the decision making authority of subnational governments.

Even if we had complete information on the revenue and expenditure autonomy of subnational governments across countries and time, we would still lack sufficient information to construct a multi-dimensional measure of fiscal decentralization. We would also, if the hypothesis that decentralization and democratic governance significantly influence one another is correct, require information on the political autonomy of subnational governments. As we noted in Chapter Two, if subnational governments are not elected through free, contestable, and separately held elections, then the potential gains from fiscal decentralization may be limited. Decentralization, in this case, may merely result in the transfer of power from a national political party (or elites) to a subnational political party. In this case, even if we had complete information on the expenditure and revenue authority of subnational governments, the lack of information on the political autonomy (and freedom) of subnational governments would prevent the construction of an accurate, multi-dimensional measure of fiscal decentralization. We are, as Oates (1972) concluded, left with the standard, albeit imperfect, measures of fiscal decentralization based on revenue and expenditure data.

The electronic version of the GFS reports data annually from 1972 onwards and contains data on the multiple levels of government, to include, where applicable: supra-national authorities, consolidated central government , budgetary central government, regional and state governments, and local governments.[77] We use the data on consolidated central governments, regional and state

[77] Consolidated central government includes the central government, extra-budgetary funds, and social security institutions.

governments, and local governments in our analysis of the impact of fiscal decentralization. To date, only countries that are members of the European Union have observations for the supra-national category and previous work has discounted the effects of these revenues and expenditures. For those countries that do not report consolidated central government data, we substitute data on the budgetary central government.[78] Of the 180 plus potential countries in the GFS data set, we selected those countries in the GFS that reported revenues and expenditures for at least the central government and at least one level of subnational government. We did not include those countries that stopped reporting revenue and expenditure information prior to 1990 and those countries whose reported data were mathematically inconsistent. We did include countries that reported zero or minimal expenditures or revenues for at least one subnational level of government. This selection process resulted in a base panel data set of 52 developed, developing, and transitional countries.

Using data from the GFS, we calculate two measures of fiscal decentralization. The measures of decentralization are: (1) the ratio of total subnational government revenues to general government revenues (*RevDec*) and (2) the ratio of total subnational government expenditures to general government expenditures (*ExpDec*). *RevDec* and *ExpDec* are standard measures of fiscal decentralization that have been widely used in the previous studies of determinants and outcomes of fiscal decentralization.[79] Previous studies of fiscal decentralization have attempted to construct measures

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[78] While budgetary central government revenues and expenditures do not equal consolidated central government revenues and expenditures, this substitution is only conducted for three countries (Fiji, Kenya, and the Phillippines) and is consistent with previous empirical work in the literature. See Davoodi and Zou (1998) for an example.

[79] See Kee (1977), Pommerehne (1977), Bahl and Nath (1986), Wasylenko (1987), Oates (1972, 1993), Davoodi and Zou (1998) and Zhang and Zou (1998), among others.

of decentralization net of grants and transfers and net of certain types of expenditures.[80] As previously discussed in this section, the GFS does not contain sufficient information to differentiate between those revenues and expenditures under the control of the central government and those revenues and expenditures under the control of subnational governments. Without country-specific information on the expenditure process and structure of the revenue system, such attempts are likely to produce biased measures of decentralization, with the bias depending on the nature of assumptions as to what revenues and expenditures should be subtracted from the aggregate measures of decentralization. Given the scope of this dissertation, we believe that, with respect to the measurement of fiscal decentralization, it is best to be consistent with the previous studies in the literature and we leave the construction of a multi-dimensional measure of fiscal decentralization to future research.

Other Data Sources

We construct an unbalanced panel data set that is drawn from five sources: the electronic version of the International Monetary Fund's *Government Finance Statistics Annual Yearbook* (1999), the World Bank's *World Development Indicators 2000* (2000)[81] , the United States Census Bureau's International Data Base (2000)[82], Freedom House's *Survey of Freedom* (2000)[83] and Deininger and Squire's (1996)[84] data set on income inequality. As we have already discussed the GFS

[80] See Woller and Phillips (1998) for an example of this approach.

[81] For an overview of the WDI, see http://www.worldbank.org/data/wdi2000.

[82] For and overview of the IDB, see http://www.census.gov/ipc/www/idbnew.html.

[83] For an overview of the SOF, see http://www.freedomhouse.org/ratings.

[84] See http://www.worldbank.org/research/growth/dddeisqu.htm for a recent review of the Deininger and Squire (1996) data set.

and the *World Development Indicators* has been extensively used in the fiscal decentralization and economic growth literature, we do not believe that an overview of these data sources is warranted at this time. We therefore provide a short discussion of the remaining data sources.

The United States Census Bureau's International Database (IDB) is an electronic database of socio-economic statistics for 227 countries and combines data from country sources with the estimates and projections of the International Programs Center of the United States Census Bureau.[85] The IDB contains country level measures of population distribution disaggregated by age and sex, fertility and mortality statistics, and data on the work-related activities of the population. We will use this data set to control for one of the determinants of economic growth (population growth) and also to examine the influence of fiscal decentralization on the infant mortality rate.

The Freedom House is an internationally recognized, non-partisan, research organization committed to promoting democratic governance and the rule of law. The Freedom House publishes the *Freedom in the World Survey* which provides an annual evaluation of freedom and democracy throughout the world. According to the 2000 *Survey*, freedom represents the ability to spontaneously act in areas that are outside government control, even though the government could exercise control if it so desired, while a democracy is a political system in which citizens choose their representatives freely among competing groups and individuals who are not designated by the government. The Freedom House assigns ratings to countries based upon the actual political and civil environment in recognition that these rights and liberties may be significantly influenced by state and non-governmental factors.

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[85] While the World Development Indicators (World Bank, 2000) database contains information on population characteristics, the IDB database is more suitable for inclusion in the panel database as it is more complete for the sample countries in the database.

The *Survey* assesses the state of freedom and democracy through two general sets of characteristics grouped under political rights and civil liberties. According to the 2000 *Survey*, political rights enable individuals to actively and freely participate in the political process at the local, regional, and national level of politics. Political rights include the right of all adults to vote and compete for political office and for elected representatives to freely vote on public policies without government interference. Civil liberties include the freedom of association, press, religion, and encompass the ability of individuals to develop views and institutions without undue government interference. We can use the rankings in the *Survey* to construct a composite index of democratic governance to investigate the relationship between fiscal decentralization and democratic governance.

The Deininger and Squire (1996) data set reports Gini coefficients for a relatively large number of countries and years relative to previous data sets on inequality.[86] Significant problems do exist when attempting to use this data to compare income inequality across countries and across time. First, two different measures of inequality are contained in the data set: those measures based upon income distribution and those measures based on the distribution of consumption. For the class of countries with income based measures of inequality, differences exist between those countries that measure inequality on the basis of gross income versus those who measure inequality on the basis of net income. Finally, while some countries use the household as the unit of measurement, other countries measure inequality using the individual as the unit of measurement.[87] While the income inequality is, as previously

[86] The Deininger and Squire (1996) database has been used by most, if not all, of the recent studies of the relationship between income inequality and economic growth, to include Dollar and Kraay (2000) and Forbes (2000).

[87] See Deininger and Squire (1996), Dollar and Kraay (2000), and Srinivasan (2000) for a discussion of these and other measurement issues with respect to income inequality.

discussed in Chapter Three, at best an imperfect proxy for interjurisdictional equality in the distribution of public resources, it is the best measure available given the absence of panel data on horizontal fiscal disparities.

The last step in the process of developing the panel data set is combining the data extracted from the GFS with the data extracted from the other data sources. This step reduces the size of the data set from approximately 1,000 observations to 610 observations due to missing observations in the socio-economic data sets.[88] While a significant reduction in the overall size of the panel data set, the result is still approximately four times larger than any previous data set on fiscal decentralization and offers us greater flexibility in the specification and estimation of the empirical models. We must note that the panel data set is unbalanced, that is, the number of countries observed in year *t* is less than or equal to the number of countries in the sample. Unlike some previous studies in the literature, we do not create linear approximations of the missing data points to increase the size and balance the panel data set.[89] A linear approximation, which may merely reflect the time-wise average of the series around the missing data points, is likely to obscure the variability in the series that may arise, in part, due to the influence of fiscal decentralization. Linear approximation may also introduce bias into the series depending upon which observations are used to create the approximations for the missing data points. It is entirely possible that the observations may reflect a period in time in which the structure of the economy is significantly different from other periods in time (during an oil or policy shock, for example).

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[88] Curiously, the majority of the missing data are from developed and not developing countries. Investment data, in particular, are difficult to obtain for developed countries.

[89] See Woller and Phillips (1998).

Given the potential problems that may result from the use of linearly approximized observations, we believe that this course of action is not appropriate for our investigation into the influence of fiscal decentralization.

Variables of Interest

We now turn to a discussion of the dependent and independent variables of interest that we use in the following chapter to estimate the influence of fiscal decentralization on technical efficiency, macroeconomic stability, democratic governance, income inequality, and economic growth. We refer the reader to Appendix B of this dissertation for a complete list of variables, their definitions, and sources and Appendix C for the list of sample countries and years for which they are present in the sample.

We will use infant mortality to test the hypothesis that fiscal decentralization significantly influences the efficiency of the provision of public services. As we noted in Chapter Three, the measurement of public sector efficiency is an imperfect science and studies have only recently focused on the effectiveness of outputs in achieving objectives.[90] We follow Gupta et al. (1997) in measuring the efficiency of public health services in developing and transitional countries with an indicator of health outcomes, that is, infant mortality. Infant mortality is defined by the *World Development Indicators* (World Bank, 2000) as the number of deaths of children under the age of 1 per 1,000 live births. While schooling measures are also used in the measurement of public sector outcomes, as well as a

[90] See Diamond (1990) for a concise review of the parametric and non-parametric approaches to estimating the efficiency of the public sector.

measure of human capital, sufficient data does not exist for the early time periods in the sample to warrant the inclusion of school variables in the panel data set.

We will use two measures of fixed investment to test the hypotheses that fiscal decentralization influences the accumulation of public and private capital. Measures of gross domestic fixed investment are readily available from the *World Development Indicators* (World Bank, 2000) for the countries in the sample. We can further disaggregate gross domestic fixed investment into gross domestic private fixed investment and gross domestic public fixed investment. Using these two variables, we can investigate the influence of decentralization on capital accumulation and also control for an important determinant of economic growth.

To test the hypotheses that fiscal decentralization significantly influences macroeconomic stability, we will use the annual change in the Consumer Price Index (CPI), more commonly know as the inflation rate, as the measure of macroeconomic stability. We noted in Chapter Three that we would prefer to use a composite index equal to the sum of the unemployment rate and the inflation rate as the measure of macroeconomic stability. As with measures of school enrollment, measures of unemployment are not readily available for the early periods in the sample. While unemployment data could be obtained directly from the countries in the sample, problems of consistency and comparability across countries and time would prohibit the use of the data. We are thus left with the annual inflation rate which we obtain from the *World Development Indicators* (World Bank, 2000).

Turning to the hypothesis that fiscal decentralization significantly influences democratic governance, we must first define a measure of democratic governance. The *Freedom in the World Survey* (2000) rates countries political rights and civil liberties on a 1 to 7 scale. A score of 1 represents a state with full respect and protection of civil liberties and where all citizens are able to choose their leaders from competing parties and individuals without government interference. A score of 7, on the other hand, represents a state in which there is no respect or protection by the state of civil liberties and the absence of free, separately held, and contestable elections. The 2000 edition of *Freedom in the World* contains annual assessments of the state of freedom in 191 countries. From this data, we follow Dailami (2000) to construct a composite index of democratic governance that ranges from 0 (complete absence of democratic governance) to 1 (fully functioning democratic system).[91] We do recognize that democratic governance, much like fiscal decentralization, is a process that should be measured in multiple dimensions and the composite measure may fail to capture all the dimensions of democratic governance. However, the measure is consistent with the literature on governance issues, comparable across countries and time, and is the only available panel data measure of democratic governance available at this time.

One of the testable hypotheses generated by the theoretical model is that fiscal decentralization may influence subnational horizontal fiscal equity. As previously discussed in Chapter Three and in this chapter, panel data on subnational horizontal equities are not available and we are left with the available, but imperfect, measure of income equality. We will use the Gini coefficient as the measure of income inequality where the Gini coefficient is equal to the ratio of the area of the actual Lorenz curve and the Lorenz curve representing the equal distribution of income. We recognize that the relationship

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[91] As noted in the previous chapter and in Appendix B, the composite index is equal to the following formula: ((14 - political rights score - civil rights score) / 12), where the political and civil rights scores range from 1 (most free) to 7 (least free). The resulting index ranges from 0 to 1.

between income equality and horizontal fiscal equities is tenuous at best and that the results based upon the income equality data should merely be indicative of the need for further analysis.

For per capita income, real GDP data are obtained from the *World Development Indicators* (2000) and total population data are obtained from the IDB (2000) database. The real GDP per capita variable is then used to calculate the economic growth variable, which is equal to the period-to-period change in real per capita GDP. See Table 1 for the descriptive statistics for the variables discussed in this section. We now turn to the task of specifying the estimations equations that are used in Chapter Five to test the hypotheses developed in Chapter Three.

Empirical Models

Only recently have panel data estimation techniques been used to investigate the impact of fiscal decentralization on economic growth.[92] We believe that the use of panel data is more appropriate to the question of the influence of fiscal decentralization in that decentralization is a diffuse process that occurs over time and cross-sectional analysis may result in incorrect inferences as to the nature of fiscal decentralization. With this in mind, we first discuss the general form of the two-way error components model before developing the estimation equations for each of the testable hypotheses.

A common observation in the economic growth literature is that it is likely that a number of unobservable individual factors, in addition to those factors that we do observe, significantly influence the steady state position, and the convergence growth path, of a country over time. We can classify the

[92] See Davoodi and Zou (1998) and Woller and Phillips (1998).

unobservable factors into those that vary across countries but not across time, those that vary across time but not across countries, and those that vary across counties and time. We must also control for the unbalanced nature of the sample where the number of time-series observations for each country in the sample is less than or equal to T, where T denotes the maximum number of time-period observations in the sample. We refer the reader to Appendix D for a expanded discussion of the two-way error components model for balanced and unbalanced panels.

Following Hsiao (1986) and Baltagi (1995), we can specify the general form of the unbalanced two-way error components panel data model as

$$y_{it} = X_{it}' \beta + u_{it} \qquad i = 1, \ldots, N_t \quad t = 1, \ldots, T \tag{16}$$

with i denoting countries and t denoting time. If the sample were balanced, i would range from 1 to N, where N represents the number of countries in the sample. However, the sample is unbalanced and i ranges from 1 to N_t where N_t ($N_t \leq N$) denotes the number of countries observed in year t and we can define the total number of observations as $n = \Sigma^t N_t$. Drawing upon Baltagi (1995), we can decompose the error term u_{it}

$$u_{it} = \mu_i + \lambda_t + \nu_{it} \qquad i = 1, \ldots, N_t \quad t = 1, \ldots, T \tag{17}$$

where μ_i represents the unobservable country specific effect, λ_t the unobservable time specific effect, and ν_{it} is the remainder stochastic disturbance term. Let D_t be the (N_t x N) matrix obtained from the identity matrix I_n by omitting the rows corresponding to countries not observed in year t, ι_t be the vector of ones of dimension T, and define

$$\Delta = (\Delta_1, \Delta_2) = \left[\begin{array}{cccc} D_1 & D_{1\iota N} & \cdots & \cdots \\ \vdots & \vdots & & \\ \vdots & & \ddots & \\ D_t & \cdots & & D_{T\iota N} \end{array} \right] \tag{18}$$

where $\Delta_1 = (D_1^{'}, ..., D_T^{'})$ is n x N and $\Delta_2 = \mathrm{diag}[\, D_{\iota}^{1}{}_{N}\,]$ is n x T. The matrix Δ defines the dummy variable structure for the unbalanced panel data model. Note that for complete panels, $\Delta_1 = (\iota_t \otimes I_n)$ and $\Delta_2 = (I_T \otimes \iota_n)$.

If we assume that the μ_i and λ_t are fixed parameters to be estimated; the ν_{it} are identically, independently distributed (IID) with zero mean and constant variance ($\nu_{it} \sim$ IID $(0, \sigma_\nu^2)$); X_{it} represents the matrix of regressors and the X_{it} are independent of ν_{it} for all i and t; and y_{it} represents the dependent variable of interest, then we can estimate the impact of fiscal decentralization using a two-way fixed effects error components model using the dummy variable structure and the unbalanced two-way error components model discussed in this section. One problem that arises with the specification of a fixed effects model is that, for panels with many individuals (countries), the dummy variable structure will be too large for feasible estimation. We can, following Hsiao (1986) and Baltagi (1995), apply the Within transformation to "sweep" the time and country specific effects. This transformation does come at a cost in that by applying the Within transformation we also "sweep" out any time-invariant and country-invariant variables.

One question that arises is whether we should consider a two-way random effects error components model instead of a two-way fixed effects error components model. By using the fixed effects approach, we explicitly assume that the observed differences between countries in the sample can be attributed to parametric shifts of the regression function.[93] While we assume that the X_{it} are independent of the ν_{it}, we do not assume that the X_{it} are independent upon the μ_i and λ_t , that is, we do not have to explicitly assume that the regressors are independent of the country specific or time specific effects. This means that the fixed effects model produces consistent estimates in the presence of heteroscedasticity. Inferences, however, are conditional on the N countries and T time periods observed in the sample. The fixed effects model, regardless of the sample size, is also costly in terms of degrees of freedom lost relative to the random effects approach.

With the random effects approach, we explicitly assume that the country and time specific effects are randomly distributed and that the parametric function varies from country to country. Unlike the fixed effects approach, inferences are not conditional on the N countries and T time periods observed in the sample and thus out-of-sample inferences can be made for the population from which the sample was randomly drawn. Since the time specific and country specific effects are random variables that are independently, identically distributed with zero mean and constant variance, the random effects model is more efficient in the absence of heteroscedasticity and serial correlation than the fixed effects model. The random effects model also allows the inclusion of time and country invariant regressors as the Within transformation is not needed to "sweep" out the country and time specific effects dummy variables. On the other hand, Baltagi (1995) noted that care must be taken in the design of the panel to make it representative of the population about which we are attempting to draw inferences. The assumption that the country and time specific effects are uncorrelated with the

[93] See Hsiao (1986) and Baltagi (1995) for further discussion of this issue.

exogenous regressors may be exceedingly strong for the purposes of this study. If this assumption was violated, the random effects model would produce inconsistent estimates. On the other hand, if the assumption was not violated, the random effects model would be consistent and more efficient than the fixed effects model if the assumptions of no serial correlation and homoscedasticity applied to the model in question.

If the disturbances were homoscedastic, we would follow Kang (1985) in employing the Hausman (1978) specification test to determine whether the random effects GLS estimator was more appropriate for the task at hand.[94] However, in the presence of heteroscedastic errors, the covariance matrix of the GLS estimator would no longer be diagonal and the GLS estimator would be inconsistent. Baltagi (1995) suggested an iterative methodology to construct a consistent covariance matrix, but this approach produces negative variance estimates that must be replaced by zero in the construction of the consistent covariance matrix.[95] In light of these problems, we believe that the fixed effects estimator is more appropriate to estimating the task of the influence of fiscal decentralization and is more consistent with the more recent studies that have attempted to examine the relationship between fiscal decentralization and economic growth. We will, however, also present the results of the random effects models for illustrative purposes.

To this point, we have discussed the relationship between fiscal decentralization and its outcomes in a singular dimension, that is, whether fiscal decentralization, all else being equal, positively

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[94] Kang (1985) noted that the Hausman test for the two-way error components model is not equivalent to the Hausman test for the one-way error components model. For the two-way error components model, he suggested a series of five Hausman tests to determine which estimator was appropriate.

[95] See Chapter Five of Baltagi (1995).

or negatively influences a variable of interest. We now introduce other control variables, that is, after controlling for the movement of other, potentially significant explanatory variables, does fiscal decentralization significantly influence the variable of interest. With this in mind, we turn to the specification of the estimation equations that we will use in Chapter Five to test the hypotheses developed in Chapter Three.

Decentralization and Infant Mortality

Our first testable hypothesis is that a change in the level of fiscal decentralization may lead to an increase in the efficiency of public expenditures which, in turn, may lead improved human capital outcomes as measured by the change in the level of infant mortality. The dependent variable of interest, infant mortality, is equal to the number of deaths of children under the age of 1 per 1,000 live births. Gupta et al. (1997) noted that infant mortality is positively influenced by the percentage of a country's population that resides in urbanized areas and central government health expenditures. La Porta et al. (1999) used infant mortality as a measure of government performance. Following Gupta et al. (1997), we will control for changes in the level of urbanization and will improve the measure of health expenditures to include the health expenditures of regional and local governments, that is, general government health expenditures. Improving on the previous analysis in the literature, we will also include a measure of openness to international trade to control for the potential impact of globalization on infant mortality.

Following Gupta et al. (1997), La Porta et al. (1999), and Clements (1999), we expand and modify Equation (3) so that for rate of accumulation of human capital, our base estimation equation is

$$\dot{H}_{it} = \beta_1 \dot{FD}_{it} + \beta_2 \dot{Urban}_{it} + \beta_3 \dot{HExp}_{it} + \delta' \dot{Z}_{it} + \mu_t + \lambda_t + \nu_{it} \tag{19}$$

where the subscripts i $(= 1,....,N_t)$ and $t(= 1,....,T)$ refer to country i at year t; N_t denotes the number of countries in the sample at period t and T the number of time periods; H is the output based measure of technical efficiency as proxied by infant mortality; FD is the measure of fiscal decentralization; *Urban* is the percentage of population living in urbanized areas, *HEx*p are per capita general government health expenditures; and the Z matrix represents the conditioning variables, to include openness to international trade (the sum of exports and imports divided by GDP), total population, and gross domestic product per capita; and the dotted variables signify the change from the previous period.[96]

Decentralization and Gross Domestic Private Fixed Investment Per Capita

As illustrated in Chapter Three, fiscal decentralization may indirectly influence economic growth through its effect on the accumulation of private capital. While this effect is not one of the conventionally addressed effects of fiscal decentralization, it is possible that decentralization influences the accumulation of private capital by increasing (or decreasing) the transparency of government operations, by enhancing (or degrading) the allocation of public resources that influence the return to private capital, or by a number of other potential channels. Given the theoretical foundation of this effect and the potential significance of private capital accumulation on economic growth, we cannot ignore this effect merely on the grounds that it is not a conventionally addressed effect of fiscal decentralization. As noted in Chapter Three, we have no a priori conclusion on the direction of the

[96] We would prefer to use measures of decentralized health expenditures. Unfortunately, these data are not readily available.

relationship between fiscal decentralization and the accumulation of private capital, as proxied by gross domestic fixed private investment per capita, over time.

We will first specify the estimation equation for the accumulation of gross domestic fixed private investment per capita before briefly discussing the issue of endogeneity. We believe that the accumulation of private capital over time is significantly influenced by a number of variables that, in turn, may be significantly influenced by the accumulation of private capital, that is, private capital accumulation may be endogenously determined with a number of other economic variables. Private capital accumulation, as noted in Chapter Three, may be significantly influenced by fiscal decentralization. Private capital accumulation may also be influenced by the macroeconomic environment, that is, by macroeconomic stability as measured by the inflation rate and by the rate of economic growth. Private capital accumulation may also be significantly influenced by the overall tax burden, as measured by total tax revenues as a percentage of GDP. A priori, we would expect that a negative relationship exists between private capital accumulation and the rate of inflation. We would also expect that a positive relationship exists between private capital accumulation and economic growth. We cannot a priori sign the relationship between private capital accumulation and total tax revenues as a percentage of GDP, as the relationship may change signs as the ratio of taxes to GDP increases from zero to one, that is, the relationship may be negative at very low and very high levels of taxes to GDP and positive in between.

Based on the preceding discussion, the general form of the estimation equation for the accumulation of private capital as proxied by gross domestic fixed private investment per capita is

$$\dot{K}_{it} = \beta_1 \dot{FD}_{it} + \beta_2 \dot{MS}_{it} + \beta_3 \dot{y}_{it} + \beta_4 \dot{Tax}_{it} + \delta' \dot{Z}_{it} + \mu_i + \lambda_t + \nu_{it} \qquad \textbf{(20)}$$

where *K* is gross domestic fixed investment per capita for the private sector at time *t*. Here, the base estimation equation includes macroeconomic stability (*MS)*, per capita GDP (*y*), total tax revenues at all levels of government as a percentage of GDP (*Tax*), and fiscal decentralization *(FD)*. As before, the dotted variables signify the change from the previous period. The *Z* matrix contains several potential conditioning variables, to include openness to international trade, defense expenditures as a percentage of GDP, and total population. We will examine whether the conditioning variables significantly influence the parameter estimates and report these results in Chapter Five.

Turning to the issue of endogeneity, we must note that some of the independent variables may be significantly influenced by the accumulation of private capital. Levine and Renelt (1992) and Ley and Steel (1999) have shown that investment is one of the few robust determinants of economic growth and thus it is possible that growth in per capita GDP may significantly influence the accumulation of private capital, which in turn may significantly influence the growth of per capita GDP. To a lesser extent, macroeconomic stability may also be endogenously determined. To control for the possibility of endogeneity for this and other variables, we will test for endogeneity in Chapter Five using the techniques discussed in Appendix D of this dissertation. If we determine that a variable is endogenous, we will use the standard Instrumental Variables (IV) methodology to control for the potential endogeneity.

<u>Decentralization and Gross Domestic Public Fixed Investment Per Capita</u>

As the effect of fiscal decentralization on the accumulation of private capital is not one of the more conventionally addressed effects of fiscal decentralization, so to is the potential influence of fiscal decentralization on the accumulation of public capital over time. If fiscal decentralization significantly influences the operations of the public sector, then it is possible that fiscal decentralization will significantly influence how the public sector allocates investment resources over time. If fiscal decentralization increases (or decreases) the accumulation of public capital over time, then, given that public investment has been shown to significantly influence economic growth, it is possible that fiscal decentralization will influence economic growth through its influence on the accumulation of public capital. As with private capital, we must be cognizant of the possibility that economic growth may influence the accumulation of public capital, that is, the growth in per capita GDP may be one of several possible endogenous variables used in the estimation of the influence of fiscal decentralization on the accumulation of public capital. To account for this possibility, we will, as discussed in the previous sub-section, test and, if necessary, control for the presence of endogeneity.

We believe that the accumulation of public capital may be influenced by a variety of factors to include fiscal decentralization, macroeconomic stability, and economic growth. As with the accumulation of private capital, we cannot a priori sign the relationship between fiscal decentralization and economic growth. We would expect a priori that a negative relationship exists between public capital accumulation, as proxied by gross domestic public fixed investment per capita, and the rate of inflation. We would also expect a priori that a positive relationship exists between public capital accumulation and economic growth. We will also include the measure of democratic governance as an independent variable to examine whether public capital accumulation is significantly influence by democratic governance. As before, we will include openness to international trade, defense expenditures as a percentage of GDP, total population, and total tax revenues as a percentage of GDP as control variables in the *Z* matrix.

With respect to the accumulation of public capital, we have hypothesized that a permanent change in the level of fiscal decentralization significantly changes the rate of accumulation of public capital. The base estimation equation is then

$$\dot{G}_{it} = \beta_1 FD_{it} + \beta_2 MS_{it} + \beta_3 y_{it} + \beta_4 \dot{Dem}_{it} + \delta' \vec{Z}_{it} + \mu_i + \lambda_t + \nu_{it} \qquad \textbf{(21)}$$

where *G* is the gross domestic fixed investment for the public sector, Here, the base estimation equation includes macroeconomic stability (*MS)*, per capita GDP (*y*), democratic governance (*Dem)*, as well as fiscal decentralization (*FD*). The *Z* matrix contains the conditioning variables previously discussed in this section.

<u>Decentralization and Macroeconomic Stability</u>

To this point we have examined the potential influence of fiscal decentralization on economic growth through the physical inputs in the production function developed in Chapter Three. We now turn to the more conventional, and contentious, effects of fiscal decentralization on macroeconomic stability, democratic governance, income inequality, and the potential direct effect of fiscal decentralization on economic growth. First, we will specify the estimation equation to examine the testable hypothesis that fiscal decentralization significantly influences macroeconomic stability as proxied by the inflation rate.

Building upon Fischer (1993) and Burki et al. (1999), we believe that the inflation rate is significantly influenced by the rate of economic growth, the growth of the money supply, and fiscal decentralization. As noted in Chapter Three, we cannot a priori state the direction of the relationship between fiscal decentralization and macroeconomic stability as proxied by the inflation rate. While some in the literature do support the contention that fiscal decentralization positively and significantly influences the rate of inflation and other forms of macroeconomic instability, the evidence on the existence of such a relationship is sparse at best. While the theoretical model in Chapter Three allows for the possibility of an indirect relationship between fiscal decentralization and economic growth through macroeconomic stability, whether such a relationship exists is unknown and is the focus of the estimation equation in this section.[97]

For macroeconomic stability, we have hypothesized that a change in the level of fiscal decentralization induces a significant change in the level of macroeconomic stability, where macroeconomic stability is proxied by the price level. Nothing that changes in macroeconomic stability have been shown to be influenced by the openness of the economy to international trade and changes in Gross Domestic Product[98], we specify the base estimation equation for macroeconomic stability as

$$\dot{MS}_{it} = \beta_1 \dot{FD}_{it} + \beta_2 \dot{M2}_{it} + \beta_3 \dot{y}_{it} + \delta' \dot{Z}_{it} + \mu_i + \lambda_t + \nu_{it} \qquad \textbf{(22)}$$

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[97] See Martinez-Vazquez (1998, 2000) and Shah (1999) for a discussion of the previous literature on the question of the relationship between fiscal decentralization and macroeconomic stability.

[98] See Fischer (1993)

where the variables are as previously discussed and M2 is the measure of M2 as a percentage of GDP, and the *Z* matrix contains the control regressors, to include openness to international trade, tax revenues as a percentage of GDP, and Gross Domestic Savings as a percentage of GDP, and the dotted variables signify the period-to-period change in these variables. As discussed previously, we will examine the impact of the control regressors to determine whether the estimated coefficient for fiscal decentralization is significant, and if it is significant, robust to the inclusion of other explanatory variables.

Decentralization and Democratic Governance

For democratic governance, we have hypothesized that a change in the level of fiscal decentralization induces a significant change in the level of governance, where governance is proxied by the composite index of democratic governance derived from the measures of civil liberties and freedom developed by the Freedom House (2000). As we discussed in Chapter Two, several studies in the literature have found a statistically significant and positive relationship between democratic governance and economic growth, although as we also noted, these studies have typically used cross-sectional data and not panel data. There does appear to be, however, wide consensus in the literature, that there is at least a positive association, if not causation, between fiscal decentralization and democratic governance.

Following Barro (1996, 1999), we believe that democratic governance is dependent upon economic growth, defense expenditures per capita, fiscal decentralization, and openness to international trade. A priori, we believe that a positive relationship exists between democratic governance, economic growth, and openness to international trade, and that a negative relationship exists between defense expenditures per capita and democratic governance. As previously noted with the other dependent variables of interest, we cannot a priori state the sign of the relationship between fiscal decentralization and democratic governance, although wide consensus does appear to exist in the literature on the positive relationship between these two variables. With this in mind, we specify the base estimation equation as:

$$\dot{Dem}_{it} = \beta_1 \dot{FD}_{it} + \beta_2 y_{it} + \beta_3 \dot{Open}_{it} + \beta_4 \dot{Def}_{it} + \delta' \vec{Z}_{it} + \mu_i + \lambda_t + \nu_{it} \qquad \textbf{(23)}$$

where the variables are as previously discussed. The *Z* matrix contains Gross Domestic Investment, Total Population, and Urbanization as control variables.

<u>Decentralization and Interjurisdictional Fiscal Disparities</u>

With respect to interjurisdictional fiscal disparities, we have hypothesized that fiscal decentralization significantly influences subnational fiscal disparities, although there is no a priori conclusion as to magnitude of the relationship or its effect on economic growth. As previously discussed, panel data on interjurisdictional fiscal disparities do not exist and we use data on interpersonal income distribution as a proxy for interjurisdictional fiscal disparities. The data are also not of sufficient quality and quantity for inclusion in the annual panel data set and we will only be able to estimate the following equation using a subset of observations. Following Birdsall et al. (1995), Deininger and Squire (1996), we specify the the following base estimation equation

$$\begin{aligned} \dot{Gini}_{it} = \beta_1 \dot{FD}_{it} + \beta_2 \dot{y}_{it} + \beta_3 \dot{Urban}_{it} + \beta_4 \dot{H}_{it} + \beta_5 I \\ + \beta_6 \dot{MS}_{it} + \delta' Z_{it} + \mu_i + \lambda_t + \nu_{it} \end{aligned} \qquad \textbf{(24)}$$

as before the subscripts $i\ (= 1,....,N_t)$ and $t(= 1,....,T)$ refer to country i at time period t; N denotes the number of countries and T the number of time periods; β_1 through β_6 are scalar parameters while δ is a vector; the dotted variables indicate the one-period change in the variable; $Gini_{it}$ is a measure of income inequality; I is gross domestic investment; MS is the measure of macroeconomic stability; and the remainder of the variables are as discussed previously.

Decentralization and Economic Growth

We now turn to the task of specifying the estimation equation for the last of the seven testable hypotheses developed in Chapter Three. We noted in Chapter Three that fiscal decentralization may have a series of indirect effects on economic output through its potential influence on the accumulation of physical and human capital and its impact on macroeconomic stability, interjurisdictional fiscal equities, and democratic governance. We also noted that fiscal decentralization, as hypothesized by some of the more recent empirical studies of fiscal decentralization, may directly influence economic output and the evolution of output over time. In this subsection, we specify the estimation equation to test the hypothesis that fiscal decentralization directly influences the growth in per capita GDP over time.

Following Barro (1991, 1996, 1999) and Mankiw et al. (1992), we believe that growth in per capita GDP is a function of physical and social capital, macroeconomic conditions, and social conditions. Referring to the results of the theoretical model, we note that the theoretical model suggests that growth in per capita GDP is a function of fiscal decentralization, human and physical capital, macroeconomic stability, horizontal fiscal equities, and democratic governance, a specification that is consistent with empirical growth literature. As with the other testable hypotheses, we cannot a priori sign the relationship between fiscal decentralization and per capita GDP growth. On the other hand, we can refer to the literature to form our expectations on the signs of the other coefficients in the estimation equation.

A priori, we believe, consistent with the literature, that a positive relationship exists between macroeconomic stability and economic growth. Given that we proxy macroeconomic stability with the inflation rate, this statement suggests that a higher inflation rate, all else being equal, lead to lower rates of economic growth. Building upon the results of Levine and Renelt (1992) and Barro (1991, 1996, 1999), we believe that sufficient justification exists to state that a positive relationship exists between private physical capital and human capital and economic growth. We do not have an a priori expectation on the sign of the coefficient for public capital as some recent empirical analyses have suggest that increased public investment may retard economic development in developing and transitional countries due to the high opportunity cost of public investment relative to contemporaneous expenditures (Gupta et al., 1997). Turning to the coefficient for the composite index for democratic governance, we believe that sufficient consensus exists in the literature on the relationship between democratic governance and growth in per capita GDP to have an a priori expectation of a positive sign for the estimated coefficient. Based upon this discussion, we specify the estimation equation for the growth in per capita GDP as

$$\begin{aligned} \dot{y}_{it} = \; & \beta_1 \, \dot{FD}_{it} + \beta_2 \dot{H}_{it} + \beta_3 \dot{K}_{it} + \beta_4 \dot{G}_{it} + \beta_5 \dot{MS}_{it} \\ & + \beta_7 \dot{Dem}_{it} + \delta' Z_{it} + \mu_i + \lambda_t + \nu_{it} \end{aligned} \tag{25}$$

where the subscripts i (= $1,\ldots.,N_t$) and $t(= 1,\ldots.,T)$ refer to country i at year t; N_t denotes the number of countries in the sample at period t and T the number of time periods. The definitions of the variables are as discussed in the previous sections and in Appendix B. The *Z* matrix contains several conditioning variables, to include openness to international trade, total population, defense expenditures, and tax revenues as a percentage of GDP.

As noted throughout this chapter, the nature of the data may present several econometric problems. First, given that we are estimating the influence of fiscal decentralization across time, the stochastic remainder disturbances in the estimation equations may be serially correlated. If the estimation equations exhibit serial correlation, then both the fixed effects and random effects estimators will be inconsistent. Second, as discussed in this chapter, a number of the regressors in *X* may be endogenous in that they may be simultaneously determined with economic growth. In such an instance, causality runs in both directions, and it is necessary to employ IV estimation to control for the endogeneity of the right hand side variables. As also discussed briefly in this chapter, the disturbances may be heteroscedastic, which would bias the standard errors in the fixed effects model and result in incorrect inferences. We discuss these and other econometric issues in the Chapter Five.

Table 1

Descriptive Statistics

Variable	Mean	Standard Deviation	Minimum	Maximum
Revenue Decentralization	25.16	16.92	0.84	86.96
Expenditure Decentralization	24.41	16.57	8.02	54.23
Infant Mortality (Deaths per 1,000 Live Births)	28.44	25.83	3.79	129.10
Gross Domestic Private Fixed Investment (% of GDP)	15.87	4.76	3.61	36.73
Gross Domestic Public Fixed Investment (% of GDP)	5.81	3.15	0.50	21.90
Inflation Rate	65.92	395.78	-7.63	7481.66
Gini Coefficient	35.98	9.43	20.69	63.43
Democratic Governance	0.76	0.27	0.01	1.00
Openness to International Trade (Exports + Imports as % of GDP)	64.30	33.70	11.35	194.92
Urbanization (% Population in Urbanized Areas)	62.78	21.15	14.18	96.33
Gross Domestic Investment (% of GDP)	22.57	5.43	6.16	43.50
Tax Revenues (% of GDP)	28.27	11.70	8.02	54.23
Defense Expenditures (% of GDP)	2.85	3.68	0.13	32.36

CHAPTER FIVE

AN EMPIRICAL EXAMINATION OF THE INFLUENCE OF FISCAL DECENTRALIZATION

Introduction

In the previous chapter, we specified the basic estimation equations that we will use in this chapter to investigate the influence of fiscal decentralization on technical efficiency, interjurisdictional fiscal equality, macroeconomic stability, democratic governance, and economic growth. Using the results of these estimations, we will, for the first time in the literature, be able to discuss the static long-term growth-effects of fiscal decentralization. However, we cannot blindly move forward with the estimation of the testable hypotheses, for, as we briefly discussed in Chapter Four, there are significant econometric issues that must be addressed. If we failed to test and control for these econometric problems, our conclusions could be based on inconsistent or inefficient parameter estimates and therefore our conclusions would be misleading.

The objective of this chapter is to empirically determine the influence of fiscal decentralization on its hypothesized outcomes. In the second section, we briefly review the econometric approach. In the third section of this chapter, we briefly discuss and test for a variety of econometric problems that may adversely affect the estimation of the testable hypotheses. In particular, we explicitly test for the presence of heteroscedasticity, serial correlation, and endogeneity and discuss the potential impact of these econometric issues on the estimation of the influence of fiscal decentralization. In the fourth section, we present the estimation results for the testable hypotheses developed in Chapter Three. For completeness, we present the estimation results for the full sample of countries and for sub-samples of developed and developing countries. Where necessary, we control for the endogeneity of specific regressors and for the presence of serial correlation of the disturbances. In the fifth section, we use the parameter estimates from the third section to develop estimates of the long-term growth impacts of the outcomes of fiscal decentralization. We conclude the section and chapter with a discussion of the potential tradeoffs between the outcomes of fiscal decentralization.

The Econometric Approach

In this chapter we estimate three basic models of the influence of fiscal decentralization. The first model is the familiar Least Squares (LS) model. Here, we explicitly assume that the country and time specific effects are jointly equal to zero and that the most efficient method of estimation is to pool all the countries in the sample. We also assume that individual countries share the same intercept and slope terms. Under these assumptions, we can pool the observations and apply the LS estimation methodology to estimate the impact of fiscal decentralization.

The second model is a two-way fixed effects error components model of fiscal decentralization. The general form of the two-fixed effects model is

$$\begin{aligned} y_{it} &= X_{it}'\beta + u_{it} \\ u_{it} &= \mu_i + \lambda_t + \nu_{it} \end{aligned} \tag{26}$$

where i ($i = 1, ..., N_t$) denotes countries, t ($i = 1, ..., T$) time, N_t the number of countries observed at time period t, T the total number of time periods, and n the number of individual observations is equal to $\Sigma_t N_t$. The disturbance term u_{it} is decomposed into individual (country) specific effects (μ_i), time specific effects (λ_t), and a remainder stochastic disturbance term (ν_{it}). We assume that the ν_{it} are identically, independently distributed (IID) with zero mean and constant variance ($\nu_{it} \sim$ IID $(0, \sigma_\nu^2)$) and X_{it} represents the matrix of regressors and the $E(X_{it} \mid \nu_{it}) = 0$ for all i and t. As we discussed in Chapter Four, the estimation results for the fixed effects estimator are strictly conditioned on the observations in the sample and out-of-sample inferences must be made with caution. We also noted that the fixed effects estimator is costly relative to the pooled LS and random effects Generalized Least Squares (GLS) estimators in terms of degrees of freedom due to the Within transformation of the regression function. The Within transformation also precludes the inclusion of individual and time-invariant regressors. On the other hand, the consistency of the Within estimator, unlike the random effects GLS estimator, is not affected by the presence of heteroscedasticity. The consistency of the Within estimator is also not dependent upon the independence of the fixed effects and the regressors (Hausman and Taylor, 1981).

The third model is a two-way random effects model of fiscal decentralization. With the random effects model, we assume that the country specific (μ_i) effects, time specific effects (λ_t), and the remainder stochastic disturbance terms (ν_{it}) are IID with zero mean and constant variance and that these variables are independent of each other and the X matrix. Given the assumption that the regression function is invariant, out-of-sample inferences can be drawn based upon the results of the random effects model. The random effects estimator also allows the inclusion of individual and time-invariant regressors and is not as costly in terms of degrees of freedom lost as the fixed effects estimator. While the random effects GLS estimator is unbiased, consistent, and efficient under the assumptions of homoscedasticity, no serial correlation, the independent of the regressors and effects, and a balanced sample ($N_t = N$ for all t), the use of an unbalanced panel creates an additional problem for the estimation of the feasible GLS variance-covariance matrix.[99] Furthermore, the random effects GLS estimator is based on the strong assumption that the effects are uncorrelated with the other regressors. If the effects are correlated with the other regressors, the random effects model is inconsistent.[100] It is for these reasons, and others discussed in Chapter Four and Appendix D, that we have decided to rely on the Within estimator for the analysis of the impact of fiscal decentralization.

For each of the testable hypotheses developed in Chapter Three, we present and discuss a series of results from each of the models discussed in this section. First, we discuss the results from the pooled LS regressions which explicitly assume that the unobservable country and time-specific effects are jointly equal to zero. We then examine the results of the Within (fixed effects) and GLS (random effects) estimators for the one-way country effects models. These models explicitly assume that the country-specific effects (μ_i) are statistically different from zero, while the time-specific effects (λ_t) are equal to zero. After the one-way country effects results, we discuss the results of the Within and GLS estimators for the one-way time effects models. Here, we assume that the country-specific effects are equal to zero while the time-specific effects are statistically different from zero. Finally, we review the

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[99] Baltagi (1995) p.161 notes that the expression for the inverse of the variance-covariance matrix for the two-way unbalanced random effects GLS estimator is "messy and asymmetric in individuals and time."

[100] See Hausman and Taylor (1981) for the treatment of endogenous effects when estimating fixed and random effects models.

results from the two-way Within and GLS estimators which explicitly assume that the country-specific and time-specific effects are singularly and jointly different from zero. The results are presented for three samples of countries: the full sample of countries listed in Appendix B of this dissertation, the sub-sample of countries classified as 'developed' by the *2000 World Development Indicators*; and the sub-sample of countries classified as 'developing' or 'transitional' by the *2000 World Development Indicators*.

While we discuss the results for the pooled, one-way, and two-way models in the following section, we only present the most pertinent results in this chapter and report the remaining results in Appendix E. For each of the one-way and two-way fixed effects estimations, we test whether the country specific and time specific effects are singulary or jointly equal to zero and report those results in this chapter for which we can reject the null hypothesis that the effects are equal to zero. In the event that we reject the null hypothesis that the time and country specific effects are jointly equal to zero, we report the results of the two-way models in this chapter and the one-way country specific and time specific estimations in Appendix E.

Econometric Issues

Having in Chapter Four specified the estimation equations for testing the hypotheses developed in Chapter Three, we now turn to the task of identifying and discussing the econometric issues that may confound the estimates. The use of panel data set in empirical estimation typically presents a number of econometric problems. We must also control for the unbalanced nature of the panel data set. In particular in this section, we discuss the issues of serial correlation, endogeneity, heteroscedasticity, and testing the significance of the fixed effects. We refer the reader to Appendix D for an extended discussion of the issues in this section.

Serial Correlation

As we are working with panel data, we need to be concerned about the possibility that the disturbances are serially correlated across time. If serial correlation is present, the fixed effects Within estimator is inefficient while the random effects GLS estimator is inconsistent. In either case, the parameter estimates are adversely affected by the presence of serial correlation. Before we can address any of the other econometric issues, we must determine whether serial correlation exists, and if we reject the null hypothesis of serial correlation, then we must correct for it.

Given that we are estimating two different types of models (pooled LS and error components), we conduct two tests for serial correlation. We believe that this approach is appropriate in the event that the individual and time specific effects are jointly equal to zero and the pooled LS model is the best linear unbiased estimator for the investigation of the impact of fiscal decentralization. On the other hand, if the individual or time specific effects are singularly or jointly different from zero, then testing for serial correlation with the fixed effects error components estimator is more appropriate as the standard errors of the pooled LS estimator will be biased. For the pooled LS estimator, the most common statistical test for the presence of serial correlation is the Durbin-Watson test, which is based on the principle that if the true disturbances are serially correlated, then the least squares residuals are also serially correlated.[101] For the fixed effects models, we can follow Bhargava, Franzini, and

[101] See Chapter 13 of Greene (1997) for additional information on the Durbin-Watson test for the LS estimator. See Chapter 5 of Baltagi (1995) for additional information on testing for serial correlation in the presence of panel data.

Narendranathan (1982) in using the Durbin-Watson statistic based on the Within residuals rather than the LS residuals to examine the hypothesis of no serial correlation.

As one might expect given the intertemporal dimension of the panel data set, we strongly reject the null hypothesis of no serial correlation at the 1% significance level for each of the equations estimated in levels. However, the base estimation equations are actually specified using the year-to-year change in the dependent and independent variables. Given that the variables in levels are non-stationary, differencing appears to be the appropriate course of action to correct the dependent and independent variables for non-stationarity. Re-estimating the pooled LS and fixed effects estimation equations in period-to-period differences, we fail to reject to the null hypothesis of serial correlation for each of the estimation equations. We believe this result supports our conclusion that differencing is the appropriate course of action to correct for non-stationary.

Heteroscedasticity

Having determined that serial correlation is not present in the disturbances of the variables in differences, we now turn to the question of heteroscedasticity. Given that we are investigating the influence of fiscal decentralization across countries of varying sizes and across time, we would expect, a priori, that the disturbances would be heteroscedastic. If the disturbances are truly heteroscedastic and we assume homoscedastic disturbances, then the fixed effects error components model produces consistent but inefficient parameter estimates. More importantly, the standard errors of the parameter estimates are biased, so proper inferences can not be made.

We use the Koenker and Bassett (1982) and Breusch and Pagan (1979) tests to determine whether we can reject the null hypothesis of homoscedasticity.[102] Under the assumption of normality, the Koenker-Bassett and Breusch-Pagan tests have the same asymptotic distribution, but it has been argued that the Breusch-Pagan test is sensitive to the assumption of normality.[103] We are able to reject the null hypothesis of homoscedasticity for the pooled LS and fixed effects models at the 1% significance level with the Koenker-Bassett and Breusch-Pagan tests. To correct the standard errors of the parameter estimates, we use the White (1980) heteroscedastic consistent covariance estimator for the pooled LS and Within estimators. We further note that the White variance-covariance estimator can be used in the presence of homoscedastic disturbances without adversely affecting the LS or Within estimator parameter estimates. Thus, even if we have improperly rejected the null hypothesis of homoscedasticity, this rejection will not adversely affect the parameter estimates of the estimated standard errors.

Endogeneity

The question of endogeneity has rarely been addressed in the fiscal decentralization literature. More recently, the empirical studies focusing on the relationship between fiscal decentralization and per capita GDP growth have explicitly assumed that the direction of causality runs from decentralization to economic growth.[104] It is interesting that the endogeneity question is ignored given that a sizable list of

[102] See Appendix D for a discussion and specification of the Koenker-Bassett and Breusch-Pagan tests and the specification of the White covariance estimator for the LS and fixed effects models.

[103] See p.553 of Greene (1997). See also Koenker (1981) and Koenker and Bassett (1982).

[104] See Davoodi and Zou (1998), Woller and Phillips (1998), Zhang and Zou (1998), and Lin and Liu (2000).

earlier studies have focused on the reverse question, that is: is the level of fiscal decentralization influenced by the level of economic development and other institutional factors?[105] Curiously, the recent literature has mostly ignored this issue, even though the body of literature on the topic, taken as a whole, suggests that causality between decentralization and economic growth may be bi-directional. We must also be aware that the potential for endogeneity exists between other sets of variables and that if we fail to test for, and if necessary control for, the presence of endogeneity, our parameter estimates will be adversely affected.[106]

If the nature of the relationship between a dependent and independent variable is bi-directional, then failing to control for endogeneity causes inconsistency in the parameter estimates. Given the number of base estimation equations, and the potential for endogeneity in each of the estimation equations, we test for endogeneity where the literature has suggested that endogeneity might be present. We use the Hausman (1978) specification test to examine the null hypothesis of exogeneity.[107] We conduct the endogeneity specification test for the pooled LS and, following Hausman and Taylor (1981), the two-way fixed effects error components models. For example, to conduct the test for the two-way error components model of per capita GDP growth, we first run the two-way error components model. We then run the first stage regression of fiscal decentralization on the instrumental

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[105] The empirical evidence in this literature suggests that fiscal decentralization is a function of the level of development, ethnic fractionalization, democratic governance, and other institutional factors. See Kee (1977), Pommerehne (1977), Bahl and Nath (1986), Oates (1993), and Panizza (1998).

[106] We are not concerned with the potential endogeneity of the fixed effects as the Within transformation sweeps the fixed effects from the transformed regression equation. As noted by Hausman and Taylor (1981), the columns of the transformed X matrix are uncorrelated with the fixed effects, and the Within estimator is unbiased and consistent for β regardless of the possible correlation between the fixed effects and the other regressors.

[107] See Appendix D for a discussion of the Hausman (1978) specification test.

variables and the fixed effects and, using the fitted value for fiscal decentralization, we run the second stage fixed effects regression for per capita GDP growth. We are unable to reject the null hypothesis of exogeneity for fiscal decentralization with respect to economic growth.[108] Using different regressors for per capita GDP and instruments for fiscal decentralization produces similar results. This result appears to support the practice in the more recent literature of treating fiscal decentralization as an exogenous determinant of economic growth. Where we are able to reject the null hypothesis of exogeneity, we will need to instrument for the variable(s) in question to consistently estimate the influence of fiscal decentralization. We are, as noted in Chapter Four, limited in our choice of regressors due to the lack of panel data beyond that already included in the sample. We also note that any instrument must be correlated with the instrumented variable and not with the contemporaneous value of the dependent variable. To control for the presence of endogeneity, we instrument, where appropriate, using the second-period lagged level of the regressor in question.[109] We believe that this course of action is appropriate and consistent with the literature.

Testing the Significance of the Fixed Effects

The remaining econometric issues is whether we will use the results of the pooled LS or Within estimators to examine the influence of fiscal decentralization on infant mortality, public and private investment, inflation, democratic governance, income inequality, and growth in per capita GDP. As we

[108] Using the Wald criterion and *Expdec* as the measure of fiscal decentralization, the test statistic for the two-way fixed effects model is 0.0163. We fail to reject the null hypothesis of exogeneity. Using *Revdec* and different permutations of the fixed effects model produced similar results. We also fail to reject the null hypothesis of exogeneity with the pooled LS model.

[109] See Baltagi (1995) and Greene (1997) for a discussion of appropriate instruments when estimating a first-differenced panel data model.

have noted in this chapter and in Appendix E, the pooled LS estimator is the best linear unbiased estimator if the country and time specific effects are jointly equal to zero. On the other hand, if unobservable, significant fixed effects exist, then the LS estimator is inefficient relative to the Within estimator. Given the number of permutations of the seven base estimation equation (LS, one-way country effects, one-way time effects, two-way country and time effects) that are examined in the following section, we rely on the statistical tests generated by the LIMDEP program to determine whether the fixed effects are statistically significant.[110] Based upon the generated statistical tests, we segregate the estimation results into those results that are to be reported in this chapter and those results that are reported in Appendix E.[111] We then highlight the preferred estimation model from the results reported at the end of this chapter. It is this preferred model that we use in the last section of the chapter to investigate the potential tradeoffs among the outcomes of fiscal decentralization.

Estimation Results

We now turn to the main empirical task of this dissertation, the determination of the influence of fiscal decentralization on technical efficiency, interjurisdictional fiscal equality, macroeconomic stability, democratic governance, and economic growth.[112] In this section, we estimate the seven testable

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[110] The number of potential tests is quite large given the seven base estimation equations, the LS and Within models for each of the base estimation equations, and the need to examine the effect of the control regressors on the fixed effects

[111] We refer the reader to Baltagi (1995) for a discussion of tests in the literature of individual and time specific fixed effects. We also refer the reader to Chapter 17 of the LIMDEP (Greene, 1998) manual for a discussion of how LIMDEP tests the significance of fixed effects.

[112] Recall that we are unable to examine the influence of fiscal decentralization on allocative efficiency due to the lack of information on input and output prices and consumer preferences.

hypotheses on the influence of fiscal decentralization using the pooled LS, one-way Within and GLS, and two-way Within and GLS estimators for the full panel of developed and developing countries and for the sub-samples of developed and developing countries. We examine the seven testable hypotheses with two different measures of decentralization to address the question of whether revenue and expenditure decentralization have significantly different effects on the variables of interest.

<u>Decentralization and Infant Mortality</u>

We now turn to the question of whether fiscal decentralization significantly influences technical efficiency. As previously discussed in Chapters Three and Four, measures of public sector technical efficiency in developing and transitional countries are scarce at best and we are left with the task of finding the most appropriate proxy for technical efficiency. Typically, the efficiency literature has focused on education and health outcomes[113], and given the lack of annual panel data on education outcomes, we have selected infant mortality, as measured by the number of infant deaths by 1,000 live births, as the outcome based measure of technical efficiency.

Recall that we have hypothesized that a permanent change in the level of fiscal decentralization may significantly change the rate of accumulation of the different forms of reproducible capital, and the base estimation equation for the investigation of whether fiscal decentralization significantly influences infant mortality outcomes is

$$\dot{H}_{it} = \beta_1 \dot{FD}_{it} + \beta_2 \dot{Urban}_{it} + \beta_3 \dot{HExp}_{it} + \delta' \dot{Z}_{it} + \mu_i + \lambda_t + \nu_{it} \tag{27}$$

[113] See Gupta et al. (1997) and Clements (1999) for examples of this approach.

i (i = 1, ..., N_t) denotes countries, t (i = 1, ..., T) time, N_t the number of countries observed at time period t, T the total number of time periods, and n the number of individual observations is equal to $\Sigma_t N_t$. H is the outcome based measure of human capital, as proxied by infant mortality; FD is the measure of fiscal decentralization; *Urban* is the percentage of total population residing in urbanized areas; *HExp* are per capita general government health expenditures; and the Z matrix represents the matrix of conditioning variables, to include GDP per capita, total population, and openness to international trade; and the dotted variables signify the change from the previous period.[114] We include defense expenditures per capita as a control variable as it has been previous suggested in the literature that a tradeoff exists between defense expenditures and infant mortality (Gupta et al., 1997).

We use the Likelihood Ratio (LR) test and F-Test to examine the hypothesis that the individual effects are jointly equal to zero.[115] Using these tests, we reject the null hypothesis that the individual effects are jointly equal to zero for the country-specific and time-specific effects. Based upon these results, we report the results of the pooled LS and two-way Within and GLS estimators in this chapter. The results for the one-way country effects and one-way time effects models are reported in Appendix E of this dissertation. Given our rejection of the null hypothesis that the individual and time specific effects are jointly equal to zero, the two-way fixed effects model is the preferred model of infant mortality for the full sample and is highlighted in Tables 4 and 5.

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[114] We refer the reader to Appendix B for a description of the variables used in this section, Appendix C for the list of sample countries and the periods for which they are observed, and Appendix D for the estimation methodology employed in this section.

[115] As noted in the previous section, LIMDEP automatically generates these test statistics when estimating a fixed effects model.

For the full sample of countries, neither expenditure decentralization (Tables 4, 50) nor revenue decentralization (Tables 5, 51) appear to significantly influence infant mortality over time.[116] We examined the impact of other regressors, to include total population, public and private investment, and the death rate per 1,000 individuals, and the insignificance of the estimated coefficients for the full sample of countries did not change. We do note that the estimated coefficient for health expenditures per capita is negative and statistically significant at the 1% level for each of the estimated models. The estimated coefficient for defense expenditures per capita is positive and statistically significant at the 1% level for each of the models, suggesting that a tradeoff exists between increased defense expenditures and infant mortality. While the estimated coefficient for urbanization is negative and statistically significant for the one-way country effects and two-way country and time effects models, it is insignificant in the pooled LS and one-way time effects models. This result appears to suggest that the estimated coefficient for urbanization is fragile to the exclusion of the country-specific effects. Overall, the results are consistent with the literature in the increased health expenditures and urbanization lower infant mortality, while increased defense expenditures increase infant mortality.[117]

Turning to the developed country sub-sample, we reject the null hypothesis that the time-specific effects are jointly equal to zero but are unable to reject the null hypothesis that the country-specific effects are jointly equal to zero. We thus present the pooled LS and one-way time effects results in this chapter, while presenting the one-way country effects and two-way country and time-

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[116] We recognize that health expenditure decentralization may significantly influence infant mortality. As noted previously, we are unable to examine the impact of health decentralization due to a lack of information on subnational health expenditures.

[117] See Gupta et al. (1997) and Barro (1999), among others.

effects results in Appendix E. Given that we have rejected the null hypothesis that the time specific effects are jointly equal to zero, the one-way time effects model is the preferred model for the sub-sample of developed countries. Unlike the full sample of countries, we are able to reject the null hypothesis that the estimated coefficient is equal to zero for expenditure decentralization at the 5% level of significance (Table 5-6) and revenue decentralization at the 10% level of significance (Table 5-7). We are unable to reject the null hypothesis that the estimated coefficient for expenditure decentralization is equal to zero for the pooled LS (Table 5-6), one-way country effects, and two-way country and time effects (Table 52) models. With respect to the estimated coefficient for revenue decentralization, we are unable to reject the null hypothesis only for the two-way fixed effects model (Table 53).

The estimated coefficients for revenue decentralization appear to be robust to the inclusion of other conditioning variables, to include total population, public and private investment, and deaths per 1,000 individuals. However, the estimated coefficients for expenditure decentralization appear to be fragile to the inclusion of the control regressors and the country-specific effects. Given the apparent fragility of the estimated coefficients for expenditure decentralization, we believe that it is appropriate to conclude that a 1% increase in revenue decentralization for the developed countries in the sample reduces infant mortality by approximately 0.1%. While a similar conclusion could be made with respect to expenditure decentralization, any such conclusion must be conditioned on the fragility of the estimated coefficient for expenditure decentralization.

The estimated coefficients for the other regressors in the developed country sub-sample estimations are, for the most part, insignificant, with the exception of urbanization. Contrary to the full sample of countries, the estimated coefficients for urbanization are positive and statistically significant for the pooled LS, one-way, and two-way fixed effects models. This is a curious result in that it suggests, for the developed countries in the sample, that increased urbanization induces increased infant mortality rates.[118] The estimated coefficient for openness to international trade is negative and weakly significant in the one-way Within models but insignificant in the pooled LS, one-way time effects, and two-way models. Including the control regressors previously discussed in this section did not improve the performance of the models or the significance of the other regressors.

With respect to the sub-sample of developing and transitional countries, we reject the null hypothesis that the country-specific and time-specific effects are singularly and jointly equal to zero and thus report the results of the pooled LS and two-way models in this chapter. We highlight the preferred two-way fixed effects model of infant mortality for the sub-sample of developing and transitional countries. The results for the one-way country effects and one-way time effects models are presented in Appendix E. As with the full sample of countries, we fail to reject the null hypothesis that the estimated coefficients for expenditure decentralization (Tables 8, 54) and revenue decentralization (Tables 9, 55) are equal to zero. Again, the inclusion of the control regressors did not improve the significance of the estimated coefficients for fiscal decentralization, and we are left to conclude that fiscal decentralization, as measured here, does not significantly influence infant mortality for the developing and transitional countries in the sample.

Examining the other regressors, we note that the estimated coefficients for health expenditures per capita and urbanization are negative and statistically significant, confirming the previous results in the

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[118] This result may suggest that, for the sub-sample of developed countries, increased urbanization may concentrate the poor within a small geographical area that lacks basic public health services. In this case, increased urbanization might result in decreased public health outcomes. This is an area that awaits research.

literature that increased urbanization and health expenditures lowers infant mortality. Urbanization again appears to be fragile to the exclusion of country-specific effects. As with the full sample, there appears to be a tradeoff between increased defense expenditures and infant mortality in that the estimated coefficient for defense expenditures per capita is positive and statistically significant at the 1% level.

These results appear to reject the hypothesis that subnational governments in developing and transitional countries may lack sufficient capacity to effectively deliver public services. The empirical evidence seems to support the argument that decentralization in developing and transitional countries does not degrade outcomes in the provision of public services. Of course, this has to be interpreted as a preliminary conclusion in that there are many other public services besides health expenditures that may be decentralized, to include education, road, and water and sewage services. Also, we must recognize that this conclusion may be dependent upon the outcome based proxy for technical efficiency and may change if we use another proxy variable or examine the outcomes of another public service.

On the other hand, for the developed countries in the sample, revenue decentralization appears to reduce infant mortality over time. This result appears to suggest that a threshold may exist for the realization of the efficiency gains results from fiscal decentralization. Of course, this result is subject to the same caveats made for the conclusion drawn for the developing and transitional country sub-sample.

<u>Decentralization and Gross Domestic Private Fixed Investment Per Capita</u>

We now turn to the task of estimating Equation (19) to determine the influence, if any, of fiscal decentralization on the accumulation of private capital. If fiscal decentralization reduces rent seeking activities by public officials or results in the more efficient allocation of resources, then it is possible that fiscal decentralization will raise the marginal rate of return to private capital and the accumulation of private capital over time. On the other hand, if fiscal decentralization increases rent seeking behavior or increased macroeconomic instability, then it is possible that increased decentralization leads to decreased private investment. Our hypothesis is that decentralization significantly influences the rate of private capital accumulation as measured by the change in the per capita gross domestic private fixed investment over time.

As noted in Chapter Four, we have hypothesized that the rate of accumulation of gross domestic private fixed investment per capita is a function of fiscal decentralization, macroeconomic stability, per capita GDP, the tax revenue to GDP ratio, and other regressors. The general form of the regression function is:

$$\dot{K}_{it} = \beta_1 \dot{FD}_{it} + \beta_2 \dot{MS}_{it} + \beta_3 \dot{y}_{it} + \beta_4 \dot{Tax}_{it} + \delta' \dot{Z}_{it} + \mu_i + \zeta_t + \nu_{it} \qquad \textbf{(28)}$$

where K_t is per capita gross domestic fixed investment for the private sector at time t, FD is the measure of fiscal decentralization, MS is macroeconomic stability as measured by the inflation rate, y is per capita GDP, Tax is the ratio of total tax revenues at all levels of government to GDP, and Z represents the matrix of conditioning variables, to include defense expenditures and total population; and the dotted variables signify the change from the previous period.[119]

Before proceeding to the estimation of the influence of fiscal decentralization on gross domestic private fixed investment per capita, we must first examine whether any of the regressors are

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119 We refer the reader to Appendix B for a description of the variables used in this section, Appendix C for the list of sample countries and the periods for which they are observed, and Appendix D for the estimation methodology employed in this section.

endogenous. We fail to reject the null hypothesis of exogeneity for fiscal decentralization with respect to gross domestic private fixed investment per capita. While we fail to reject the null hypothesis for inflation, the tax ratio, and the control regressors (total population, defense expenditures as percentage of GDP), we reject the null hypothesis at the 1% level of significance for per capita Gross Domestic Product. As one might expect a priori, higher rates of per capita GDP growth induce higher rates of private investment, which in turn, spur per capita GDP growth. To control for the endogeneity of the per capita GDP variable, we follow Hamilton (1994) and Baltagi (1995) and use the two-period lagged level of per capita GDP as the instrument for the first difference of per capita GDP. We then use the standard instrument variables (IV) approach to estimating the influence of fiscal decentralization on private investment.

While we are unable to reject the null hypothesis that the country-specific effects are jointly equal to zero for the full sample of countries, we are able to reject the null hypothesis for the time-specific effects at the 1% level of significance for the LR and F tests. Based on these results, we present the pooled IV and one-way time effects IV Within and GLS estimation results in this chapter. Given the results of the LR and F tests, the one-way fixed time effects model is the preferred model of private investment for the full sample of countries. The estimation results for the one-way country effects and two-way country and time effects models are reported in Appendix E.

Examining the results from the full sample estimations, it would appear that neither expenditure decentralization (Table 10, 56) or revenue decentralization (Table 11, 57) significantly influences the accumulation of per capita gross domestic private fixed investment over time. While the estimated coefficients for expenditure and revenue decentralization are negative in each of the estimation models, they do not approach any meaningful level of significance. The estimated coefficients remain insignificant to the inclusion of other regressors. We are left to conclude that, for the full sample of developed and developing countries, fiscal decentralization does not significantly influence the accumulation of gross domestic private fixed investment per capita over time.

Turning to the other regressors in the full sample Within estimations, we note that the estimated coefficients for inflation are negative and statistically significant at the 1% level for each of the estimation models. As one might expect, these results suggest that countries that experience higher rates of inflation over time have lower rates of private capital accumulation. We also note that the estimated coefficients for the tax ratio and per capita GDP are positive and statistically significant at the 1% level, suggesting that countries that are growing faster and raising more revenues as a percentage of GDP have higher rates of private investment. Finally, while the estimated coefficients for defense expenditures are negative and statistically significant in the pooled IV model (Tables 10, 11), they become insignificant with the inclusion of the country-specific (Tables 56, 57) and time-specific effects.

As with the full sample of countries, we are unable to reject the null hypothesis that the country-specific effects are jointly equal to zero for the sub-sample of developed countries. We are, as with the full sample, able to reject the null hypothesis for the time-specific effects and thus present the pooled IV and preferred one-way time effects results in this chapter. As before, the one-way country effects and two-way country and time-effects results are reported in Appendix E of this dissertation. With respect to the sub-sample of developed countries, expenditure decentralization (Tables 12, 58) does not appear to significantly influence the accumulation of per capita gross domestic fixed investment over time. On the other hand, revenue decentralization (Tables 13, 59) does appear to negatively influence the accumulation of private capital over time for the sample countries in that the estimated coefficient for revenue decentralization is negative and statistically significant at the 1% level for each of the estimation models. A 1% increase in revenue decentralization appears to induce an approximately 0.3% decrease in private capital accumulation for the developed countries in the sample. The estimated coefficients for revenue decentralization appear to be robust to the inclusion of other regressors, to include public investment, openness to international trade, and health expenditures per capita. Given the apparent robustness of the estimated coefficients for revenue decentralization, we are left with the conclusion that, for the developed countries in the sample, increases in revenue decentralization retard the accumulation of gross domestic private fixed investment per capita.

With respect to the other regressors in the developed country sub-sample estimations, we note that the time-specific effects provide most of the explanatory power of the models. Only per capita GDP is consistently significant in each of the estimation models (pooled, one-way, two-way), illustrating the positive relationship between per capita GDP and the accumulation of private capital over time. While the estimated coefficients for inflation are negative, they are not significant as in the full sample estimations. The estimated coefficient for the tax ratio is positive but only weakly significant in the Within one-way time effects (Table 12) and two-way (Table 58) models of expenditure decentralization.

For the sub-sample of developing and transitional countries, we are able to reject the null hypothesis for the time-specific effects at the 1% level of significance for the LR and F tests. Based on these results, we present the pooled IV and preferred one-way time effects IV Within and GLS estimation results in this chapter. The estimation results for the one-way country effects and two-way country and time effects models are reported in Appendix E. While the estimated coefficients for expenditure decentralization (Tables 14, 60) and revenue decentralization (Tables 15, 61) are negative, they are not statistically significant, suggesting that fiscal decentralization does not significantly influence the accumulation of gross domestic private investment per capita for the developing and transitional countries in the sample. As with the full sample, the inclusion of other regressors does not improve the significance of the decentralization coefficients.

With respect to the other regressors, the estimated coefficients are consistent with our expectations. The estimated coefficients for inflation are negative and statistically significant at the 1% level, with the exception of the two-way IV Within estimator for revenue decentralization (Table 61), where it is significant at the 5% level. The estimated coefficients for defense expenditures are also negative and statistically significant for the pooled IV and one-way IV Within time effects models (Tables 14, 61) but insignificant for the one-way IV Within country effects and two-way IV Within models. The estimated coefficients for the tax ratio and per capita GDP are positive and statistically significant for each of the estimation models, illustrating the positive relationship between these variables and per capita gross domestic private fixed investment.

In summary, these results appear to suggest that expenditure decentralization does not significantly influence the accumulation of private capital, as proxied by gross domestic private fixed investment per capita, for the developing and transitional countries in the sample. As with the results for infant mortality, these results again appear to reject the hypothesis that expenditure decentralization presents obstacles to development in developing and transitional countries. As before, we caution that this result can only be made for the countries in the sample as we are using a fixed effects model for the investigation of the influence of fiscal decentralization on its hypothesized outcomes.

With respect to the developed countries in the sample, increased revenue decentralization appears to reduce the accumulation of private capital over time. This is a somewhat unexpected result that warrants further investigation. It may be that there is not a monotonic relationship between fiscal decentralization and private investment, or that the negative influence of fiscal decentralization on private investment only occurs after a certain level of development has been achieved (much as with infant mortality). Again, we caution that this result may be dependent upon the proxy used for private investment and may be different if other proxies are used to investigate the influence of fiscal decentralization.

Decentralization and Gross Domestic Public Fixed Investment Per Capita

Our next task in this chapter is to investigate the potential influence of fiscal decentralization on the accumulation of public capital, as proxied by gross domestic public fixed investment per capita, for the countries in the sample. If subnational government officials respond to fiscal decentralization by increasing revenue mobilization or through the more efficient allocation of subnational public resources, then we may observe an increase in the accumulation of public capital over time. On the other hand, if fiscal decentralization results in local capture and the diversion of public resources in response to the preferences of the local elite, or if local governments do not have sufficient capacity to adequately manage public resources, then we may observe a decrease in the accumulation of public capital over time.

In Chapter Three, we hypothesized that fiscal decentralization significantly influences the accumulation of public capital, with no a priori expectation on the direction of the relationship. Recall from Chapter Four that the base estimation equation is

$$\dot{G}_{it} = \beta_1 \dot{FD}_{it} + \beta_2 \dot{MS}_{it} + \beta_3 \dot{y}_{it} + \beta_4 \dot{Dem}_{it} + \beta_5 \dot{Tax}_{it} + \mu_i + \lambda_t + \nu_{it} \qquad \textbf{(29)}$$

where *G* is the gross domestic public fixed investment per capita; *FD* is fiscal decentralization, *MS* is macroeconomic stability as proxied by the inflation rate, *y* is per capita GDP, *Dem* is the composite index of democratic governance, *Tax* is the tax-to-GDP ratio, and the dotted variables indicate the period-to-period change of the respective variables.[120]

As with the estimation of the influence of fiscal decentralization on the accumulation of gross domestic private fixed investment per capita, we fail to reject the null hypothesis of exogeneity for fiscal decentralization with respect to the accumulation of gross domestic public fixed investment per capita. We also fail to reject the null hypothesis of exogeneity for the other regressors in the regression function, with the exception of per capita Gross Domestic Product. Following the methodology used in the previous sub-section, we use the two-period lagged level of per capita GDP to instrument for the first difference of per capita GDP. For the full sample of developed and developing countries, we are able to reject the null hypothesis that the country-specific and time-specific effects are singularly and jointly equal to zero and thus report the results of the pooled IV, preferred two-way IV Within, and the

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[120] We refer the reader to Appendix B for a description of the variables used in this section, Appendix C for the list of sample countries and the periods for which they are observed, and Appendix D for the estimation methodology employed in this section.

two-way random effects GLS estimations at the end of this chapter. The results of the one-way country effects and one-way time effects IV estimators are reported in Appendix E.

For the full sample of countries, expenditure decentralization (Table 16, 62) appears to positively and significantly influence the rate of accumulation of per capita gross domestic public fixed investment. As illustrated in Table 16, a 1% increase in expenditure decentralization raises the accumulation of per capita public investment by approximately 0.2%, a result that is consistent across the pooled IV, one-way (Table 16), and two-way models of fiscal decentralization. On the other hand, revenue decentralization (Tables 17, 63) does not appear to significantly influence the rate of per capita public capital accumulation. While the coefficients for revenue decentralization are consistently negative in the pooled IV (Table 17), one-way IV (Table 63), and two-way IV (Table 17) models, they do not approach any meaningful level of significance. The coefficients for expenditure decentralization appear to be robust to the inclusion of other regressors, to include M2 as a percentage of GDP, urbanization, total population, and openness to international trade. The inclusion of these regressors also does not improve the significance of the estimated coefficients for revenue decentralization. These results appear to suggest that, for the countries in the sample, expenditure decentralization, and not revenue decentralization, significantly and positively influences the rate of public capital accumulation.

Turning briefly to the other regressors in the full sample estimations, we note that only the estimated coefficients for defense expenditures and democratic governance are statistically significant across the different estimation models. The estimated coefficients for defense expenditures are positive and statistically significant at the 1% level, suggesting that increased defense expenditures translates into higher rates of gross domestic fixed investment. On the other hand, the estimated coefficients for democratic governance are negative and statistically significant at the 1% level, suggesting that as countries become more "free", rates of public capital investment decline.[121] As political and civil rights increase, resources may be reallocated from public investment to other purposes. The estimated coefficients for per capita GDP are positive and significant for the one-way Within time effects and two-way Within country and time effects estimators, affirming our a priori expectation of a positive relationship between per capita GDP growth and growth in public investment.

While we are unable to reject the null hypothesis that the country-specific effects are equal to zero for the sub-sample of developed countries, we are able to reject the null hypothesis for the time-specific effects, and thus report the pooled IV, preferred one-way fixed time effects, and one-way random time effects results in this chapter. The results from the one-way country effects and two-way country and time effects IV models are reported in Appendix E of this dissertation. As with the full sample estimations, we again find a positive and statistically significant relationship between expenditure decentralization (Table 18, 64) and gross domestic public fixed investment per capita. A 1% increase in expenditure decentralization leads to an approximately 0.5% increase in the rate of public capital accumulation. The estimated coefficients for fiscal decentralization are significant at the 1% level for the pooled IV (Table18) and one-way country effects (Table 18) Within estimations and at the 5% level for the preferred one-way time effects (Table 18) and two-way (Table 64) Within estimations. As with the full sample estimations, we fail to reject the null hypothesis that the estimated coefficients for revenue decentralization are equal to zero, and are thus left with the conclusion that expenditure decentralization,

[121] As noted in Appendix C, the measure of democratic governance ranges from 0 (no civil or political rights) to 1 (complete civil and political rights) and is constructed from the *Survey of Freedom* (2000).

and not revenue decentralization, significantly and positively influences the rate of public capital accumulation for the developed countries in the sample.

With respect to the other regressors, we observe that the estimated coefficients for inflation are negative and statistically significant at 5% level for the pooled IV and one-way time effect models (Tables 18, 19) and at the 10% level for two-way Within models (Tables 64, 65). The estimated coefficients for inflation are insignificant for the one-way country effects Within model, however, we have already noted that the country effects are jointly insignificant and the pooled IV and one-way time effects Within estimators are more efficient in terms of degrees of freedom than the one-way country effects Within estimator. Defense expenditures per capita are, as in the full sample, positive and statistically significant at the 1% level for each of the estimation models, while per capita GDP is only significant for the pooled IV and one-way country effects Within estimators. Unlike the full sample, the estimated coefficients for democratic governance are insignificant for the Within estimators, which may be do to the lack of variation in the democratic governance variable for the developed countries in the sample.

For the sub-sample of developing and transitional countries, we are able to reject the null hypothesis that the country effects and time effects are singularly and jointly equal to zero and thus report the results for the pooled IV, preferred two-way Within estimator, and the two-way GLS estimators in this chapter. The results for the one-way country effects and one-way time effects models are reported in Appendix E. For the pooled IV and two-way Within estimations (Table 20) and the one-way country effects (Table 66) models, we are able to reject the null hypothesis for the estimated coefficient for expenditure decentralization at the 5% level of significance. We are unable to reject the null hypothesis for the one-way time effects Within estimator for expenditure decentralization (Table 66). On average, it appears that a 1% increase in expenditure decentralization induces a 0.2% increase in the accumulation of per capita gross domestic public fixed investment over time for the developing and transitional countries in the sub-sample.

As in the full sample and sub-sample of developed countries, we are unable to reject the null hypothesis for the estimated coefficients for revenue decentralization. Including other regressors, to include total population, openness to international trade, and government consumption as a percentage of GDP, does not affect the significance of the estimated coefficients for revenue decentralization. Given the apparent robustness of the coefficients for expenditure decentralization and the insignificance of the estimated coefficients for revenue decentralization, we conclude that, for the developing and transitional countries in the sub-sample, expenditure decentralization (and not revenue decentralization) positively and significantly influences the accumulation of per capita gross domestic public fixed investment over time.

Examining the other regressors, we note that per capita GDP is positive and statistically significant for each of the estimation models. Defense expenditures are also positive and statistically significant, suggesting that for developing and transitional countries, increased defense expenditures translates into increased public investment, but at a less than 1 to 1 ratio. As in the full sample, the estimated coefficient for democratic governance is negative and statistically significant, suggesting that a negative relationship exists between political and civil liberties and public investment. This finding may lend credence to the argument that less "free" countries missallocate public resources into large, non-productive investments ("white elephants") and that as citizens are granted their "voice" in government, resources are reallocate from these investments to other goods and services. This finding also appears to support the arguments made by the World Bank and the International Monetary Fund that capital expenditures provide opportunities for corruption and graft in developing and transitional economies (World Bank, 1999, 2000).

In summary, for the countries in the sample, expenditure decentralization positively and significantly influences the accumulation of per capita gross domestic public investment over time. The impact of expenditure decentralization on public investment appears to be dependent upon the level of development in that a 1% increase in expenditure decentralization induces an approximately 0.5% increase in public capital accumulation in developed countries and a 0.2% increase in developing and transitional countries. We failed to find a statistically significant relationship between revenue decentralization and public capital accumulation. Of course, these findings are subject to the same caveats made for infant mortality and private capital accumulation and warrant further investigation.

Decentralization and Macroeconomic Stability

In this sub-section, we examine the hypothesis that fiscal decentralization significantly influences macroeconomic stability. As previously discussed in Chapter Four, we would prefer to use the misery index (inflation rate plus unemployment rate) as our measure of macroeconomic stability. Unfortunately, we lack sufficient data on unemployment across countries and time to construct the misery index variable for inclusion in the annual panel data set. Instead, we use the inflation rate, which is one component of the misery index, as the proxy variable for macroeconomic stability.

Whether or not fiscal decentralization enhances (or degrades) macroeconomic stability is a contentious issue in the literature. On one side, there are those who have argued that, at a minimum, decentralization presents another obstacle for developing and transitional countries to achieving macroeconomic stability.[122] They noted that decentralization reallocates some of the revenue and expenditure instruments used by the central government to achieve macroeconomic stability. Since subnational governments are, in effect, small open economies, any attempt at macroeconomic policy is prone to leakage. On the other side, there are those who have noted that decentralization may allow subnational governments to more effectively address the asymmetric nature of macroeconomic shocks.[123] Also, decentralization may create the need for the clarification of the roles of specific institutions in government, both at the center and subnational level, which may in fact enhance macroeconomic stability..

In Chapter Three, we hypothesized that fiscal decentralization significantly influences macroeconomic stability, as measured by the inflation rate, but that we did not know a priori the sign or magnitude of the relationship. In Chapter Four, we drew upon Fischer (1993) and specified the base estimation for examining the testable hypothesis as to the influence of fiscal decentralization on macroeconomic stability as

$$\dot{MS}_{it} = \beta_1 \dot{FD}_{it} + \beta_2 \dot{M2}_{it} + \beta_3 \dot{y}_{it} + \delta' \dot{Z}_{it} + \mu_i + \lambda_t + \nu_{it} \qquad \textbf{(30)}$$

where *MS* is the level of macroeconomic stability as measured by the inflation rate, *FD* is the measure of fiscal decentralization, *M2* is the measure of M2 as a percentage of GDP, *y* is the measure of per capita GDP, the *Z* matrix contains the control regressors, to include openness to international trade, tax

[122] Prud'homme (1995) and Tanzi (1996) are two examples of these arguments.

[123] See McLure (1995), Sewell (1996), and Spahn (1997) for examples of this side of the argument.

revenues as a percentage of GDP, and Gross Domestic Savings as a percentage of GDP, and the dotted variables signify that these variables are measured in first differences (or period to period change).[124]

Turning to the issue of endogeneity, we fail to reject the null hypothesis of exogeneity with respect to fiscal decentralization. We also fail to reject the null hypothesis of exogeneity for openness to international trade, tax revenues as a percentage of GDP, and Gross Domestic Savings as a percentage of GDP. We do reject the null hypothesis at the 1% level of significance for M2 as a percentage of GDP and for per capita GDP. Based on this result, we instrument for the first difference of M2 as a percentage of GDP with the two-period lagged level of M2 as a percentage of GDP and for the first difference of per capita GDP with the two-period lagged level of per capita GDP.

For the full sample of countries, we are able to reject the null hypothesis that the country and time-specific effects are singularly and jointly equal to zero and thus present the pooled IV, preferred IV two-way Within, and two-way random effects IV estimation results in this chapter. The estimation results for the one-way IV country effects and one-way IV time effects models are reported in Appendix E.

The most important result of the full sample estimations is the negative and statistically significant relationship between fiscal decentralization and the rate of inflation. The estimated coefficients for expenditure decentralization are negative and statistically significant at the 1% level for the pooled IV model (Table 22), and at the 10% level for the one-way country effects and time effects Within models

[124] We refer the reader to Appendix B for a description of the variables used in this section, Appendix C for the list of sample countries and the periods for which they are observed, and Appendix D for the estimation methodology employed in this section.

(Table 68) and for the preferred two-way within model (Table 22). The estimated coefficients for revenue decentralization are negative and statistically significant at the 1% level for the pooled IV and preferred two-way IV Within model (Table 23) and at the 5% level for the one-way IV Within country effects and IV Within time effects (Table 69) models. A 1% increase in expenditure decentralization induces, for the countries in the sample, an approximately 0.2% decrease in the rate of inflation, while a similar increase in revenue decentralization leads to an approximately 0.3% decrease in the rate of inflation. While the estimated coefficients for revenue decentralization are robust to the inclusion of other regressors (including total population, defense expenditures, and urbanization), the estimated coefficients for expenditure are fragile to the inclusion of these regressors. We must therefore interpret the estimated coefficients for expenditures decentralization with caution. For the full sample of countries, we conclude that revenue decentralization mildly reduces the rate of inflation. While expenditure decentralization may also mildly reduces the rate of inflation, we cannot make a firm statement about this effect due to the fragility of the estimated coefficients for expenditure decentralization.

Turning to the results of the other regressors, we note that the sign of the estimated coefficients for these regressors is consistent with the our a priori expectations. The estimated coefficients for M2 as a percentage of GDP are positive but insignificant, while the coefficients for the tax ratio and openness to international trade are negative and insignificant. As expected, the estimated coefficients for per capita GDP are negative and statistically significant at the 1% level, suggesting that countries that are growing faster have lower rates of inflation. The estimated coefficients for Gross Domestic Savings as a percentage of GDP are positive and significant in the pooled IV, one-way country effects, and preferred two-way country and time effects models.

With respect to the sub-sample of developed countries, we fail to reject the null hypothesis that the time-specific effects are jointly equal to zero but are able to reject the null hypothesis for the country-specific effects. We thus present the pooled IV, preferred one-way country effects Within, and one-way country effects GLS estimation results in this chapter and the results for the one-way IV time effects and two-way IV country and time effects models in Appendix E. For the sub-sample of developed countries, the estimated coefficients for expenditure decentralization (Tables 24, 70) are insignificant. The estimated coefficients for revenue decentralization (Tables 25, 71) are also, for the most part, insignificant, with the exception of the preferred one-way fixed country effects and one-way random country effects GLS models. While the random effects models are not corrected for heteroscedasticity and the standard errors of the estimated coefficients are biased downwards, the estimated standard errors of the one-way fixed country effects models have been corrected for heteroscedasticity, suggesting that revenue decentralization negatively and significantly influences the rate of inflation. The estimation results suggest that a 1% increase in fiscal decentralization leads to a 0.4% decrease in the rate of inflation. We do note, however, that the performance of the estimation models for the sub-sample of developed countries is poor relative to the full sample and the estimated coefficients for most of the regressors appear to be fragile to the inclusion (or exclusion) of the fixed effects.

Examining the results of the regressions for the sub-sample of developing and transitional countries, we note that expenditure decentralization (Tables 26, 72) does not appear to significantly influence the rate of inflation over time. While the estimated coefficients for expenditure decentralization are negative, none of the estimated coefficients approach any meaningful level of significance. On the other hand, the estimated coefficient for revenue decentralization for the one-way country effects model (Table 27) is negative and weakly significant at the 10% level. However, we must also note that the estimated coefficient for revenue decentralization appears fragile to the inclusion of time-specific effects (Table 73) and is also insignificant for the two-way IV model.

In summary, we have found evidence to support the hypothesis that revenue decentralization lowers the rate of inflation for the full sample of countries. A 1% increase in revenue decentralization, for the countries in the full sample, appears to lower the rate of inflation by approximately 0.3%. This result appears to support the line of reason of McLure (1995), Sewell (1996), Spahn (1997), and Shah (1999), that fiscal decentralization may enhance macroeconomic stability. We have also observed a statistically significant relationship exists between fiscal decentralization and inflation for the sub-samples of developed and developing and transitional countries. This result casts doubt on the argument that fiscal decentralization presents an obstacle to macroeconomic stability in developing and transitional countries.

Decentralization and Democratic Governance

Fiscal decentralization and democratic governance are widely viewed as two complementary policies, with governance providing the channel for constituents to participate in local government, and decentralization providing local governments with the resources to provide goods and services to their constituents. Having also examined and rejected the argument that fiscal decentralization is endogenously determined with respect to democratic governance, we now seek to address the question of whether fiscal decentralization significantly influences democratic governance.

Previous empirical studies have noted that democratic governance is positively and significantly influenced by the level of economic development, that is, governance appears to be a superior good. With this in mind, we specify the base estimation equation as:

$$\dot{Gov}_{it} = \beta_1 \dot{FD}_{it} + \beta_2 \dot{y}_{it} + \beta_3 \dot{Open}_{it} + \beta_4 \dot{Def}_{it} + \mu_i + \lambda_t + \nu_{it} \qquad \textbf{(31)}$$

where the variables are as previously discussed. We first regressed this base estimation equation in levels, correcting for serial correlation with the Corchane-Orcutt procedure, to replicate the results in the literature. We did find that per capita GDP in levels positively and significantly influences the level of democratic governance. We also determined that countries with higher levels of defense expenditures have lower levels of democratic governance. While the estimated coefficients for openness to international trade were positive, they were not significant. These results suggest that we are able to replicate the results for the estimation in levels presented in the literature.[125] However, as noted previously in this chapter, our base estimation equations are specified in first differences, not in levels.[126]

Previously in Chapter Two, we noted that fiscal decentralization may influence democratic governance, which, in turn, may influence the level of fiscal decentralization. Decentralization may result

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[125] See Dethier (1999a, 1999b) for an example.

[126] We refer the reader to Appendix B for a description of the variables used in this section, Appendix C for the list of sample countries and the periods for which they are observed, and Appendix D for the estimation methodology employed in this section.

in the strengthening of democratic institutions at the subnational level of government and increased participation as individuals find their voice in government. As the level of democratic governance increases, this in turn may lead to more decentralization as subnational governments become more adept at responding to the tastes and preferences of their constituents. However, we fail to reject the null hypothesis of exogeneity for fiscal decentralization with respect to democratic governance.

While we are able to reject the null hypothesis that the country-specific effects are jointly equal to zero, we are unable to reject the null hypothesis for the time-specific effects. Based on these results, we present the results of the pooled LS and preferred one-way country effects estimations in this chapter and the results of the one-way time effects and two-way country and time effects estimations in Appendix E. We fail to reject the null hypothesis that the estimated coefficient for fiscal decentralization with respect to democratic governance is zero for the full, developed, and developing country samples. In the full sample of countries, the estimated coefficients are negative, however, they are both close to zero and are not statistically significant. While the estimated coefficients for per capita GDP and openness to international trade are negative, they are not statistically significant for the two-way error components model. While these findings suggest that there is not a relationship between democratic governance and per capita GDP, we caution that the regression function is specified in first differences, and not in levels, and thus the results suggest that there is not a statistically significant relationship between changes in democratic governance and fiscal decentralization for the sample countries. We must caution that our failure to find a statistically significant relationship may be the result of the countries included in the sample. We note, however, that we have examined the effect of other regressors and the results are similar in nature.

As with the full sample of countries, we are able to reject the null hypothesis that the country effects are jointly equal to zero and unable to reject the null hypothesis for the time effects for the sub-samples of developed and developing countries. We thus present the results of the pooled LS, preferred one-way fixed country effects, and one-way random country effects estimations in this chapter and the results of the one-way time effects and two-way country and time effects estimations in Appendix E. In the sub-sample of developed countries, we are again unable to reject the null hypothesis that the estimated coefficients for fiscal decentralization are equal to zero. In the sub-sample of developing countries, the estimated coefficients are also negative, but insignificant, and the regressions have little explanatory power.

In short, we have failed to detect a statistically significant and robust relationship between fiscal decentralization and democratic governance. This result appears to be somewhat surprising given the wide consensus in the literature on the relationship between fiscal decentralization and democratic governance. However, we believe that our result is superior to the previous results in the literature given that we are employing panel rather than cross-section data and that our econometric approach is more sophisticated than the previous attempts to examine the relationship between fiscal decentralization and democratic governance. While some may argue that our result is due to the specification of the estimation equations in first differences and not in levels (which has been the traditional approach in the cross-sectional literature examining the relationship between fiscal decentralization and democratic governance), we believe that the previous studies have, at best, detected an association between decentralization and governance and not causation between these two processes. We believe that future research of this issue is warranted given the interest in the relationship between decentralization and governance.

Decentralization and Interjurisdictional Equality

We now turn to the question of whether fiscal decentralization exacerbates interjurisdictional inequalities in the distribution of resources. As previously noted, data for the distribution of resources across subnational governments across countries and time do not exist and we must use income distribution data as a proxy for horizontal fiscal equality. We readily acknowledge that income inequality is an imperfect proxy for horizontal fiscal equality since per capita income and per capita subnational expenditures (revenues) do not have to be closely correlated.[127] Furthermore, the data on income distribution is limited and we are only able to examine this question for a sub-sample of countries and for a limited number of time periods. We are able to reject the null hypothesis that the country and time effects are singularly and jointly equal to zero and present the results of the pooled LS and two-way error components estimations in this chapter. The estimation results for the one-way country effects and one-way time effects models are presented in Appendix E.

The most important result of the analysis is that revenue decentralization appears to decrease inequality in the distribution of resources as measured by income distribution, which is contrary to the consensus in the literature. On average, it appears that for the sample countries reporting income inequality data, that a 1% increase in fiscal decentralization reduces income inequality by approximately 0.3%. We must caution that this observation is made with a limited number of observations and that the

[127] However, in the United States and other developed countries, demand for the level of public goods is based on the median voter model and there is an explicit linkage between per capita income and expenditures per capita (and tax revenues per capita).

estimated coefficient for fiscal decentralization is fragile.[128] We also note that the estimated coefficient for expenditure decentralization is insignificant and it appears that the country effects by themselves provide the most significant amount of explanatory power for the regressions. The estimated coefficients for investment and health expenditures as a percentage of GDP are negative and consistent with the literature on the relationship between income inequality and per capita GDP growth (Perotti 1996, Forbes 2000). However, the estimated coefficients for the period-to-period change per capita GDP are not consistent with the more recent literature in that they suggest that increased economic growth increases income inequality, a finding which is contrary to that of Dollar and Kraay (2000) and Forbes (2000). We examined the impact of other regressors and specifications and the estimated coefficient for GDP remained negative. This result may be the result of the small number of observations due to the limited nature of the income inequality data and we must use caution in interpreting the results of these estimations.

We believe that the estimation results suggest that a negative relationship may exist between income distribution and revenue decentralization. Further empirical investigation of this hypothesis is warranted and requires the construction of a panel data set on interpersonal and interjurisdictional equality in the distribution of resources. Given the paucity of data for these two variables of interest, we must leave this question for future research.

Decentralization and Economic Growth

[128] Out of the 610 observations in the sample, only 180 report income inequality data.

We now turn to the final empirical question of this dissertation: what is the effect of fiscal decentralization on economic growth. In Chapter Two of this dissertation, we reviewed the existing empirical evidence on the influence of fiscal decentralization on economic growth and found that there is no clear consensus in the literature as to the impact of fiscal decentralization on economic growth. If Oates (1993) is correct, then the static proposition that fiscal decentralization is efficiency enhancing, has a corresponding proposition in the dynamic setting of economic growth. The theoretical model motivating this empirical analysis illustrates that a direct relationship between decentralization and economic growth is possible, yet the question remains whether the relationship can be empirically substantiated. What has been ignored in the literature and what has been the focus of this dissertation is whether fiscal decentralization indirectly influences economic growth through its influence on technical efficiency, macroeconomic stability, interjurisdictional fiscal equalities, and democratic governance. In this section we not only examine whether fiscal decentralization directly effects economic growth but whether the indirect effects of fiscal decentralization significantly influence economic growth.

Recall from Chapter Four that we have specified the base estimation equation for economic growth as:

$$\begin{aligned} \dot{y}_{it} = \ & \beta_1 \dot{FD}_{it} + \beta_2 \dot{H}_{it} + \beta_3 \dot{MS}_{it} + \beta_4 \dot{K}_{it} + \beta_5 \dot{G}_{it} \\ & + \beta_6 \dot{Dem}_{it} + \delta' Z_{it} + \mu_i + \lambda_t + \nu_{it} \end{aligned} \quad \textbf{(32)}$$

where the evolution of per capita GDP (y) over time is a function of: fiscal decentralization (FD), infant mortality (H), macroeconomic stability *(MS)*, private capital *(K)*, public capital *(G)*, democratic governance (Dem), and the control regressors (Z). As before, the dotted variables signify the period-to-period change in these variables. Using this base estimation equation, we can examine whether the hypothesized direct relationship between fiscal decentralization and economic growth exists (i.e. whether β_1 is statistically significant) and whether the indirect outcomes of fiscal decentralization significantly influence economic growth (i.e. whether the other β are statistically significant).[129]

For the full sample of countries, we are able to reject the null hypothesis that the country and time-specific effects are jointly equal to zero and present the results of the pooled IV, preferred two-way Within, and two-way GLS models in this chapter. We present the results of the one-way country effects and one-way time effects models in Appendix E. As previously noted in the beginning of this chapter, we failed to reject the null hypothesis of exogeneity for fiscal decentralization with respect to growth in per capita GDP. We have, however, rejected the null hypothesis of exogeneity for the inflation rate, gross domestic fixed private investment per capita, and gross domestic public fixed investment per capita. As before, we instrument for these endogeneous regressors with the two-period lagged level of the regressor in question.

One of the most important empirical findings of this dissertation is the failure to detect, for the full sample of countries, a statistically significant relationship between fiscal decentralization and growth in per capita GDP over time. While the estimated coefficients for expenditure decentralization (Tables 36, 82) are positive, they do not approach any meaningful level of statistical significance. The same finding applies to the estimated coefficients for revenue decentralization (Tables 37, 83). We note that the estimated coefficients for revenue decentralization, unlike those for expenditure decentralization, are

[129] We refer the reader to Appendix B for a description of the variables used in this section, Appendix C for the list of sample countries and the periods for which they are observed, and Appendix D for the estimation methodology employed in this section.

negative. However, the insignificance of the estimated coefficients prevents us from drawing any conclusions with respect to the sign (or magnitude) of the coefficients. The inclusion of other control regressors, to include total population, M2 as a percentage of GDP, and defense expenditures, did not improve the significance of the estimated coefficients for expenditure and revenue decentralization. We are left with the conclusion that, for the full sample of countries, there does not appear to be a statistically significant, direct relationship between fiscal decentralization and economic growth.

Turning to the other regressors, we note that the estimated coefficients are consistent with that in the economic growth literature.[130] The estimated coefficients for infant mortality are negative and statistically significant at the 5% level for the pooled IV and two-way IV models. While the estimated coefficients for infant mortality are insignificant with respect to the one-way IV country effects model, they are significant for the one-way IV time effects model. Increased infant mortality may be a signal of the inefficient delivery (or absence) or health services and may retard economic growth over time. Also, as expected, the estimated coefficients for inflation are negative and significant at the 5% level for the pooled IV and two-way IV models and at the 10% level for the one-way IV models. The coefficients for public and private investment are positive and statistically significant at the 1% level, which is consistent with the literature on economic growth.[131] Finally, the estimated coefficients for democratic governance are positive and statistically significant. An increase in civil or political rights appears to increase per capita GDP over time.

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[130] See Barro (1990, 1991, 1996, 1999), among others.

[131] For an example, see Levine and Renelt (1992).

We can now observe the indirect effect of fiscal decentralization on growth in per capita GDP. As already noted in the sub-section of the relationship between fiscal decentralization and inflation, revenue decentralization reduces the rate of inflation for the full sample of countries. The results in this section suggest that a negative relationship exists between inflation and economic growth. Thus, an increase in revenue decentralization, all else being equal, would reduce the rate of inflation over time, and in turn, enhance economic growth over time. The question, which we address in the next section, is whether these individual, indirect effects have an positive or negative aggregate influence on economic growth.

For the sub-sample of developed countries, we fail to reject the null hypothesis that the country-specific effects are jointly equal to zero and report the results of the pooled IV, preferred one-way IV Within, and one-way GLS estimations in this chapter. The estimation results for the one-way country effects and two-way IV models are reported in Appendix E. Examining the results of the sub-sample estimations, we note that there appears to be a negative and statistically significant relationship between fiscal decentralization and growth in per capita GDP. The estimated coefficients for expenditure decentralization (Tables 38, 84) are statistically significant for the one-way time effects Within estimator and the two-way Within estimator but insignificant for the pooled IV and one-way country effects Within estimator. As already noted, the country-specific effects are jointly equal to zero (as evidenced by the small increase in R^2 from the pooled IV to one-way country effects models) and we are left with the result of a statistically significant and negative relationship between expenditure decentralization and economic growth. With respect to revenue decentralization (Tables 39, 85), the estimated coefficients are negative and statistically significant at the 1% level for each of the estimation models. While the estimated coefficient for revenue decentralization is robust to the inclusion of the control regressors (total population, defense expenditures, M2 as a percentage of GDP), the estimated coefficients for expenditure decentralization are fragile. As before, we must exercise caution when interpreting the estimated coefficients for expenditure decentralization due to the apparent fragility of these coefficients. We are left with the conclusion that, for the developed countries in the sub-sample, increases in revenue decentralization negatively influences economic growth. While there appears to be a similar relationship for expenditure decentralization, the apparent fragility of the estimated coefficients prevents us from making such a firm statement.

Turning to the other regressors in the estimations, we note that the time-specific effects provide the largest increase in explanatory power relative to the pooled IV model. Unlike the full sample estimations, infant mortality and inflation are no longer statistically significant. The coefficients for these two variables are close to zero for the one-way time effects (Tables 38, 39) and two-way models (Tables 84, 85). As in the full sample estimations, the estimated coefficients for public and private investment are positive and statistically significant at the 1% level. Finally, the estimated coefficients for democratic governance are the negative but insignificant. This may be due to the lack of variation in the democratic governance measure for the developed countries in the sub-sample.

For the sub-sample of developing and transitional countries, we are able to reject the null hypothesis that the country and time-specific effects are singularly and jointly equal to zero and report the results of the pooled IV, preferred two-way IV Within, and two-way GLS models in this chapter. The results of the one-way country effects and one-way time effects models are reported in Appendix E. As with the full sample estimations, we fail to detect a statistically significant relationship between fiscal decentralization and growth in per capita GDP. The estimated coefficients for expenditure decentralization (Tables 40, 86) and revenue decentralization (Tables 41, 87) are positive and negative, respectively, but insignificant. Based on this empirical evidence, we conclude, for the countries in the sub-sample, that fiscal decentralization does not directly influence economic growth.

However, the failure to detect a direct linkage between decentralization and growth does not mean that fiscal decentralization can not indirectly influence growth in per capita GDP. The estimated coefficients for infant mortality are negative and significant at the 1% level of the two-way Within and at the 5% level for the one-way time effect Within estimators. As in the full sample, the estimated coefficients for inflation are negative and significant, albeit at the 10% level for the two-way Within estimator and 5% for the one-way time effects estimator. However, unlike the full sample, the estimated coefficients for public and private investment are not statistically significant for the two-way Within estimator. While the estimated coefficients for private and public investment are statistically significant for the pooled IV, only public investment is significant in the one-way country effects Within model, and only private investment is significant for the one-way time effects Within model. These results suggest that the estimated coefficients for public and private investment are fragile to the inclusion of the fixed effects. Finally, the estimated coefficients for democratic governance are positive and statistically significant at the 1% level for the two-way Within model and the one-way country effects Within model. The coefficients are not significant for the pooled IV and one-way time effects Within models. This result suggests that, as with the full sample, increased political rights and civil liberties enhance economic growth for the sample countries.

In summary, we have failed to detect a direct and statistically significant relationship between fiscal decentralization and economic growth for the full and developing samples of countries. However, we have found a direct and negative relationship between revenue decentralization and economic growth for the sub-sample of developed countries. This result may suggest that further decentralization for the developed countries in the sample would result in decreased per capita GDP growth.

Summary of Estimation Results

We have, for the first time in the literature, conducted an empirical examination of the conventional impacts of fiscal decentralization and have illustrated the channels through which fiscal decentralization may indirectly influence economic growth. Before turning to the task of discussing the potential tradeoffs among the outcomes of fiscal decentralization, we must first summarize the empirical results in this section. To assist the reader, we group the results by type of decentralization and testable hypothesis.

In Table 2 we summarize the empirical estimation results for the investigation of the influence of fiscal decentralization. If the estimated coefficient for expenditure decentralization in the preferred model is not statistically significant, we do not report the estimated coefficient. On the other hand, if the estimated coefficient is statistically significant in the preferred estimation model, the value of the estimated coefficient is reported in the table below. Increases in expenditure decentralization appear to positively influence health outcomes, as proxied by infant mortality, for the sub-sample of developed countries. We have not found any empirical evidence to support the contention that expenditure decentralization significantly influences private investment, as proxied by gross domestic private fixed investment. On the other hand, we have found consistent empirical support for the testable hypothesis that expenditure decentralization significantly influences public investment, as proxied by gross domestic public fixed investment. The empirical results appear to support the contention that the impact of decentralization is more pronounced in developed rather than in developing and transitional countries. We do not find any empirical evidence to support the hypothesis that expenditure decentralization significantly influences democratic governance. While we did find support for the previous results in the literature that the level of fiscal decentralization significantly and positively influences the level of democratic governance, we failed to find a similar relationship when the estimation equations were estimated in first differences. This result may suggest that decentralization and democratic governance are positively associated but no direct causality exists between the two variables. We also failed to detect any significant relationship between expenditure decentralization and income inequality. Finally, while we failed to detect a significant relationship between expenditure decentralization and economic growth in the full and developing country samples, we did detect a statistically significant relationship between the two variables for the developed countries in the sample. This finding appears to suggest the existence of a direct, negative relationship between decentralization and economic growth which is dependent upon the level of development.

We summarize the empirical results for the influence of revenue decentralization in the Table 3. As with expenditure decentralization, we fail to find a statistically significant relationship between revenue decentralization and infant mortality for the full and developing and transitional country samples. We do, as with expenditure decentralization, find a negative and statistically significant relationship between revenue decentralization and the outcome based measure of technical efficiency for the sub-sample of developed countries. This result appears to suggest that the technical efficiency effects of fiscal decentralization may be dependent upon the level of development, that is, a threshold exists for the gains of fiscal decentralization to be realized. We also note that revenue decentralization appears to negatively and significantly influence the accumulation of private investment for the sub-sample of developed countries, while revenue decentralization appears to have no effect on the accumulation of public capital. We do find that increased revenue decentralization results in lower rates of inflation for each of the samples under examination. This is a significant result in that one of the main arguments against decentralization is that, at a minimum, presents obstacles to macroeconomic stability. As with expenditure decentralization, we fail to find a statistically significant relationship between revenue decentralization and democratic governance, although we do find a statistically significant relationship between revenue decentralization and income inequality. However, we note that the result for income inequality should merely be indicative of the need for future research given the data and measurement problems noted in Chapter Four. Finally, we note that, as with expenditure decentralization, a statistically significant and negative relationship appears to exists between fiscal decentralization and per capita GDP growth for the developed countries in the sample. It may be, as noted with respect to infant mortality, that decentralization has significantly different effects in developed versus developing and transitional countries. We believe that our findings appear to refute those in the literature who have suggested that decentralization promotes instability and retards growth in developing countries.

The Tradeoffs Among the Outcomes of Fiscal Decentralization

In this section, we address the two remaining questions of this dissertation: what is the static impact of fiscal decentralization on economic growth; and what are the potential tradeoffs between the outcomes of fiscal decentralization. First, we examine the direct and indirect effects on economic growth of a one-standard deviation change in fiscal decentralization. To do this, we use the parameter estimates developed in the previous section to examine the static influence of fiscal decentralization. Using the static long-term growth estimates, we then discuss the potential tradeoffs between economic efficiency, macroeconomic stability, democratic governance, and the direct influence of fiscal decentralization on economic growth.

The Long-Term Growth Impact of Fiscal Decentralization

The thought experiment is to increase each of the measures of fiscal decentralization by one-standard deviation and to calculate the long-term effect on per capita GDP. In Tables 42 through 47, the first column reports the estimated coefficient pertaining to the direct effect of fiscal decentralization on that variable, while the second column reports the estimated coefficient for that variable with respect to economic growth. We first multiply the estimated coefficient for the direct effect of fiscal decentralization by the one-standard deviation of fiscal decentralization to obtain the effect of a one-standard change of fiscal decentralization on the change in the variable of interest over time. We then multiply the resulting value by the estimated parameter of the impact of the variable of interest on the change in per capita GDP over time to obtain the static long-term growth impact of fiscal decentralization through the variable of interest. While we report the static growth impact calculations for each of the variables of interest, the aggregate growth impact is derived only from those coefficients that are statistically significant. If the estimated coefficient for fiscal decentralization for the variable of interest or for the variable of interest with respect to per capita GDP growth is statistically insignificant, then we treat the static growth impact through the variable of interest on economic growth as zero. Given the significant reallocation of resources that would have to occur for a one-standard deviation increase (or decrease) in either expenditure or revenue decentralization, we only investigate a one-standard deviation change in decentralization. We believe that while a two-standard deviation change would encompass 95% of the individuals in the population, such a significant change in decentralization is not practical in terms of analysis.

We present two examples of this methodology in this paragraph. In the first example, the estimated coefficient for expenditure decentralization with respect to gross domestic public fixed investment for the full sample of countries (Tables 16, 42) is 0.2323. We multiply 0.2323 by the one-standard deviation change in expenditure decentralization (0.1657) to obtain 0.0385 which we then multiply by the estimated coefficient for gross domestic public fixed investment (0.2434) in the growth equation (Tables 36, 42) to obtain the static growth impact of 0.0094. We estimate that the static impact of a one-standard deviation increase in expenditure decentralization an approximate increase of 3.85 percent in the rate of gross domestic public fixed investment which, in turn, induces an approximate static increase in per capita GDP growth of 0.94 percent. If, for example, the per capita GDP growth rate was 3.0%, a one-standard deviation increase in expenditure decentralization would, all else being equal, raise the per capita GDP growth rate to approximately 3.03%.

On the other hand, we note that in Table 43 the estimated coefficient for revenue decentralization for infant mortality for the full sample of countries is -0.0033 and that the estimated coefficient for infant mortality for per capita GDP growth is -0.1531, resulting in an estimated static growth impact of 0.0001. While the estimated coefficient for infant mortality with respect to per capita GDP growth is statistically significant at the 5% level, the estimated coefficient for revenue decentralization with respect to infant mortality is not statistically significant. We thus conclude that, for the full sample of countries, revenue decentralization does not significantly influence public health outcomes and revenue decentralization does not significantly influence per capita GDP growth through the infant mortality channel. In fact, the only channel through which revenue decentralization appears to significantly influence long-term per capita GDP growth is through its statistically significant influence on inflation.

The main result from the thought experiment is that the growth impact of fiscal decentralization is moderate in magnitude. For the full sample of countries, a one-standard deviation increase in expenditure decentralization results in an approximately 0.94% increase in per capita GDP growth over the long-run. A similar increase in revenue decentralization for the full sample of countries would increase per capita GDP growth by approximately 0.35% in the long-run. If revenue and expenditure decentralization occur simultaneously, these results suggest that the overall effect would be a increase in per capita GDP growth over the long-run. Of course, a one-standard deviation increase in expenditure or revenue decentralization would entail a significant reallocation of resources among different levels of government and it is more likely that we will observe smaller changes in decentralization, and thus smaller impacts on economic growth, over time.

For the developed sample of countries, the long-run impact of fiscal decentralization is a reduction in per capita GDP growth over the long-run. A one-standard deviation increase in expenditure decentralization, all else remaining equal, would reduce per capita GDP growth by approximately 0.95% in the long-run. A corresponding increase in revenue decentralization would reduce per capita GDP growth by approximately 7.24% in the long-run. The static influence of fiscal decentralization on per capita GDP growth is more pronounced in the sub-sample of developed countries due to the statistically significance of the estimated coefficients for decentralization with respect to per capita GDP growth. If, for example, the per capita GDP growth rate was 3.0%, a one-standard deviation increase in revenue decentralization would, all else being equal, lower the per capita GDP growth rate to approximately 2.8%. The results for the thought experiment suggest that, for the developed countries in the sample, fiscal decentralization appears to reduce economic growth over the long-run.

For the developing and transitional sample of countries, the impact of fiscal decentralization appears to a slight increase in the per capita GDP growth rate. A one-standard increase in expenditure decentralization appears to increase per capita GDP growth by approximately 0.46%, while a similar increase in revenue decentralization appears to reduce economic growth by approximately 0.20% in the long-run. If revenue and expenditure decentralization occurred simultaneously, the overall effect would be a slight increase in per capita GDP growth over the long-term. As with the other results in this chapter, this result again appears to suggest that the influence of fiscal decentralization is dependent upon the level of development of the countries in question, with the influence of fiscal decentralization being more pronounced in the sub-sample of developed countries. This result also appears to support the contention by Davoodi and Zou (1998) that there is not a monotonic relationship between decentralization and growth and that an optimal level of decentralization exists with respect to economic growth. It may be that the developed countries in the sample have decentralized past the optimal level of decentralization and further decentralization would only serve to reduce the rate of growth in these countries. Examining the influence of decentralization in a dynamic setting is a question we leave for future research.

The Tradeoffs Between the Outcomes of Fiscal Decentralization

We now turn to the question of the tradeoffs between the outcomes of fiscal decentralization. As previously discussed in Chapter Two, the literature to date has largely ignored the potential tradeoffs among the outcomes of fiscal decentralization, focusing instead on the direct relationship between fiscal decentralization and economic growth. While the direct relationship between fiscal decentralization and economic growth is an important dimension of the outcomes of fiscal decentralization, as illustrated for the sub-sample of developed countries in the previous section, it is not the only channel through which fiscal decentralization may affect per capita GDP growth. The questions that remain are whether tradeoffs exists among the outcomes of fiscal decentralization and what, if any, are the directions and magnitudes of the tradeoffs.

For the full sample of countries, there do not appear to be statistically significant tradeoffs between different outcomes of fiscal decentralization. Expenditure decentralization appears to significantly and positively influence per capita GDP growth through public investment while revenue decentralization appears to have a similar, statistically significant effect through its negative impact on inflation. As noted earlier in this chapter, we fail to find any other statistically significant relationships between fiscal decentralization and per capita GDP growth for the full sample of countries. While there appear to be tradeoffs between decentralization and public and private investment, for example, the estimated effects are not statistically significant and we therefore cannot make inferences based upon these estimated coefficients.

For the developed sample of countries, there appears to be a statistically significant tradeoff with respect to expenditure decentralization. Expenditure decentralization appears to directly and significantly depress per capita GDP growth while indirectly and positively influencing per capita GDP growth through increased public investment. The overall effect appears to be a slight reduction in long-term per capita GDP growth. Revenue decentralization, on the other hand, negatively influences per capita GDP growth through its direct effect and its indirect effect on private investment. As with the full sample of countries, there appear to be other potential tradeoffs among the hypothesized outcomes of fiscal decentralization, however, we are unable to draw any conclusions due to the insignificance of the estimated coefficients.

Turning to the developing and transitional sample of countries, there is insufficient empirical evidence to support the contention that tradeoffs exists among the hypothesized outcomes of fiscal decentralization. Expenditure decentralization appears to positively influence long-term per capita GDP growth through its positive influence on public investment while revenue decentralization appears to positively influence economic growth through its negative influence on the inflation rate. As with the full sample of countries, we cannot draw conclusions on the existence of tradeoffs based upon statistically insignificant coefficients.

In summary, while the theoretical model developed in Chapter Three presented the possibility of tradeoffs among the outcomes of fiscal decentralization, we have been unable, with the exception of the developed country sub-sample, to find empirical support for the existence of tradeoffs. We do not believe that our failure to find tradeoffs among the outcomes of fiscal decentralization is a sign that these tradeoffs do not exist but that the process of decentralization may be more diffuse than originally thought and that further analysis of this issue may still reveal the hypothesized tradeoffs. It may be that the tradeoffs are not among the aggregated outcomes of fiscal decentralization (efficiency, macroeconomic stability, democratic governance) but exist within each of these outcomes. Decentralization may create tradeoffs among different types of public programs (health, education, transportation) or institutions (political liberties, civil rights). We leave this question for future research.

Table 2

Summary of Results for Expenditure Decentralization

Variable	Full Sample	Developed Sample	Developing Sample
Infant Mortality	none	-0.1856*	none
Private Investment	none	none	none
Public Investment	0.2323**	0.4925*	0.1872*
Inflation	-0.1623+	none	none
Democratic Governance	none	none	none
Gini Coefficient	none	–	–
Economic Growth	none	-0.2736**	none

Table 3

Summary of Results for Revenue Decentralization

Variable	Full Sample	Developed Sample	Developing Sample
Infant Mortality	none	-0.1395+	none
Private Investment	none	-0.3345**	none
Public Investment	none	none	none
Inflation	-0.2566**	-0.4142+	-0.1386
Democratic Governance	none	none	none
Gini Coefficient	-0.3294**	–	–
Economic Growth	none	-0.3141**	none

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. $N = 555$.

2: Summary of Results for Expenditure Decentralization
3: Summary of Results for Revenue Decentralization

Table 4

Estimation Results for All Sample Countries

Infant Mortality with Expenditure Decentralization

Variable	Pooled Least Squares	**Within (Two Way)**	GLS (Two Way)
Expenditure Decentralization	-0.0031 (0.0204)	**-0.0078** **(0.0201)**	0.0043 (0.0203)
Urbanization (% of Total Population)	-0.2537 (0.2090)	**-1.6932**** **(0.4463)**	-1.1071** (0.3349)
Health Expenditure (Per Capita)	-0.0316** (0.0088)	**-0.0250**** **(0.0073)**	-0.0282 (0.0088)
Openness to Trade (% of Gross Domestic Product)	-0.0087 (0.0278)	**0.0043** **(0.0322)**	-0.0022 (0.0300)
Defense Expenditure (Per Capita)	0.0386** (0.0164)	**0.0482**** **(0.0171)**	0.0432** (0.0164)
Gross Domestic Product (Per Capita)	-0.0334 (0.0264)	**-0.0123** **(0.0362)**	-0.0168 (0.0284)
Constant	-0.0358** (0.0034)		-0.0309** (0.0077)
df	548	**480**	548
R^2	0.0368	**0.2345**	0.0234

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. $N = 555$. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 5

Estimation Results for All Sample Countries

Infant Mortality with Revenue Decentralization

Variable	Pooled Least Squares	**Within (Two Way)**	GLS (Two Way)
Revenue Decentralization	-0.0116 (0.0198)	**-0.0033** **(0.0187)**	-0.0068 (0.0198)
Urbanization (% of Total Population)	-0.2677 (0.2096)	**-1.7063**** **(0.4459)**	-1.1169** (0.3338)
Health Expenditure (Per Capita)	-0.0318** (0.0088)	**-0.0253**** **(0.0075)**	-0.0286** (0.0088)
Openness to Trade (% of Gross Domestic Product)	-0.0099 (0.0278)	**0.0041** **(0.0320)**	-0.0030 (0.0301)
Defense Expenditure (Per Capita)	0.0389** (0.0162)	**0.0472**** **(0.0166)**	0.0426** (0.0162)
Gross Domestic Product (Per Capita)	-0.0342 (0.0263)	**-0.0110** **(0.0351)**	-0.0164 (0.0282)
Constant	-0.0356** (0.0034)		-0.0308** (0.0077)
df	548	**480**	548
R^2	0.0373	**0.2343**	0.0350

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. *N* = 555. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 6

Estimation Results for Developed Countries

Infant Mortality with Expenditure Decentralization

Variable	Pooled Least Squares	**Within One-Way Time Effects**	GLS One-Way Time Effects
Expenditure Decentralization	-0.1286 (0.0817)	**-0.1856*** **(0.0937)**	-0.1299^{+} (0.0798)
Urbanization (% of Total Population)	1.0887** (0.2699)	**0.9446**** **(0.2250)**	1.0877** (0.2639)
Health Expenditure (Per Capita)	-0.0082 (0.0149)	**-0.0080** **(0.0104)**	-0.0082 (0.0146)
Openness to Trade (% of Gross Domestic Product)	-0.1027 (0.0676)	**-0.0764** **(0.1093)**	-0.1021 (0.0663)
Defense Expenditure (Per Capita)	-0.0330 (0.0531)	**-0.0173** **(0.0539)**	-0.0329 (0.0519)
Gross Domestic Product (Per Capita)	0.0291 (0.0616)	**0.0071** **(0.0959)**	0.0292 (0.0603)
Constant	-0.0438** (0.0050)		-0.0438** (0.0049)
df	257	**233**	257
R^2	0.2140	**0.3195**	0.2140

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. $N = 264$. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 7

Estimation Results for Developed Countries

Infant Mortality with Revenue Decentralization

Variable	Pooled Least Squares	**Within One-Way Time Effects**	GLS One-Way Time Effects
Revenue Decentralization	-0.1663* (0.0752)	**-0.1395+ (0.0825)**	-0.1623* (0.0745)
Urbanization (% of Total Population)	0.9500** (0.2814)	**0.9575** (0.2389)**	0.9580** (0.2804)
Health Expenditure (Per Capita)	-0.0083 (0.0148)	**-0.0091 (0.0103)**	-0.0084 (0.0147)
Openness to Trade (% of Gross Domestic Product)	-0.1158+ (0.0675)	**-0.0947 (0.1058)**	-0.1060 (0.0694)
Defense Expenditure (Per Capita)	-0.0292 (0.0521)	**-0.0053 (0.0546)**	-0.0272 (0.0520)
Gross Domestic Product (Per Capita)	0.0166 (0.0607)	**0.0122 (0.0946)**	0.0171 (0.0620)
Constant	-0.0421** (0.0050)		-0.0424** (0.0054)
df	257	**233**	257
R^2	0.2213	**0.3144**	0.2212

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. $N = 264$. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 8

Estimation Results for Developing Countries

Infant Mortality with Expenditure Decentralization

Variable	Pooled Least Squares	**Within Two-Way**	GLS Two-Way
Expenditure Decentralization	0.0007 (0.0210)	**0.0012** **(0.0192)**	-0.0050 (0.0193)
Urbanization (% of Total Population)	-0.4120^{+} (0.2421)	**-1.5018**** **(0.4489)**	-0.7372** (0.2957)
Health Expenditure (Per Capita)	-0.0424** (0.0108)	**-0.0326**** **(0.0090)**	-0.0416** (0.0101)
Openness to Trade (% of Gross Domestic Product)	-0.0020 (0.0303)	**-0.0493** **(0.0356)**	-0.0659 (0.0296)
Defense Expenditure (Per Capita)	0.0476** (0.0171)	**0.0495**** **(0.0148)**	0.0469** (0.0158)
Gross Domestic Product (Per Capita)	-0.0472 (0.0301)	**-0.0488** **(0.0419)**	-0.0414 (0.0291)
Constant	-0.0286** (0.0051)		-0.0250** (0.0075)
df	285	**234**	285
R^2	0.0936	**0.4077**	0.0863

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. $N = 292$. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 9

Estimation Results for Developing Countries

Infant Mortality with Revenue Decentralization

Variable	Pooled Least Squares	**Within Two-Way**	GLS Two-Way
Revenue Decentralization	-0.0048 (0.0203)	**-0.0002** **(0.0172)**	-0.0030 (0.0190)
Urbanization (% of Total Population)	-0.4224^{+} (0.2425)	$\mathbf{-1.5137^{**}}$ **(0.4494)**	-0.8653^{**} (0.3176)
Health Expenditure (Per Capita)	-0.0427^{**} (0.0108)	$\mathbf{-0.0332^{**}}$ **(0.0092)**	-0.0414^{**} (0.0102)
Openness to Trade (% of Gross Domestic Product)	0.0014 (0.0305)	**-0.0051** **(0.0354)**	-0.0029 (0.0300)
Defense Expenditure (Per Capita)	0.0475^{**} (0.0170)	$\mathbf{0.0481^{**}}$ **(0.0143)**	0.0463^{**} (0.0158)
Gross Domestic Product (Per Capita)	-0.0472 (0.0300)	**-0.0467** **(0.0409)**	-0.0362 (0.0291)
Constant	-0.0285^{**} (0.0051)		-0.0238^{**} (0.0082)
df	285	**234**	285
R^2	0.0938	**0.4068**	0.0813

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. $N = 292$. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 10

Estimation Results for All Sample Countries

Gross Domestic Private Fixed Investment Per Capita with Expenditure Decentralization

Variable	IV Pooled	**IV - Within One-Way Time Effects**	IV - GLS One-Way Time Effects
Expenditure Decentralization	-0.0393 (0.0767)	**-0.0492** **(0.0981)**	-0.0462 (0.0708)
Inflation	-0.1714** (0.0409)	**-0.1647**** **(0.0672)**	-0.1704** (0.0382)
Defense Expenditures (% of Gross Domestic Product)	-0.1487** (0.0627)	**-0.1119** **(0.0703)**	-0.1179* (0.0576)
Tax Revenues (% of Gross Domestic Product)	0.5619** (0.1343)	**0.5339**** **(0.2234)**	0.5414** (0.1248)
Gross Domestic Product (Per Capita)	1.2143** (0.1687)	**1.6918**** **(0.2355)**	1.4484** (0.1850)
Total Population	-0.0533 (0.1252)	**-0.1479** **(0.1144)**	-0.0609 (0.1192)
Constant	-0.0152 (0.0137)		-0.0326 (0.0221)
df	500	**477**	500
R^2	0.1960	**0.3674**	0.1917

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. N = 507. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 11

Estimation Results for All Sample Countries

Gross Domestic Private Fixed Investment Per Capita with Revenue Decentralization

Variable	IV Pooled	**IV - Within One-Way Time Effects**	IV - GLS One-Way Time Effects
Revenue Decentralization	-0.0844 (0.0743)	**-0.0308 (0.00787**	-0.0492 (0.0688)
Inflation	-0.1737^{**} (0.0409)	**-0.1652^{**} (0.0677)**	-0.1717^{**} (0.0382)
Defense Expenditures (% of Gross Domestic Product)	-0.1414^{*} (0.0624)	**-0.1066 (0.0684)**	-0.1127^{*} (0.0574)
Tax Revenues (% of Gross Domestic Product)	0.5352^{**} (0.1352)	**0.5198^{**} (0.2189)**	0.5242^{**} (0.1253)
Gross Domestic Product (Per Capita)	1.2036^{**} (0.1687)	**1.6865^{**} (0.2386)**	1.4290^{**} (0.1844)
Total Population	-0.0631 (0.1245)	**-0.1212 (0.1099)**	-0.0583 (0.1184)
Constant	-0.0144 (0.0137)		-0.0307 (0.0214)
df	500	**477**	500
R^2	0.1977	**0.3671**	0.1936

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. $N = 507$. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 12

Estimation Results for Sample Developed Countries

Gross Domestic Private Fixed Investment Per Capita with Expenditure Decentralization

Variable	IV Pooled	**IV - Within One-Way Time Effects**	IV - GLS One-Way Time Effects
Expenditure Decentralization	0.1338 (0.2113)	**0.0549 (0.1724)**	0.0589 (0.1656)
Inflation	-0.0236 (0.1193)	**0.0314 (0.0633)**	0.0259 (0.0959)
Defense Expenditures (% of Gross Domestic Product)	-0.3514** (0.1392)	**-0.1425 (0.1249)**	-0.1717 (0.1154)
Tax Revenues (% of Gross Domestic Product)	0.2169 (0.2687)	**0.4472+ (0.2686)**	0.4236* (0.2156)
Gross Domestic Product (Per Capita)	1.3365** (0.2452)	**1.9005** (0.4405)**	1.4378** (0.3120)
Total Population	-1.2217 (1.7522)	**-0.5854 (1.3381)**	-0.8931 (1.3751)
Constant	-0.0343 (0.0237)		-0.0420 (0.0323)
df	243	**220**	243
R^2	0.1276	**0.5396**	0.1136

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. $N = 250$. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 13

Estimation Results for Sample Developed Countries

Gross Domestic Private Fixed Investment Per Capita with Revenue Decentralization

Variable	IV Pooled	**IV - Within One-Way Time Effects**	IV - GLS One-Way Time Effects
Revenue Decentralization	-0.5608** (0.1989)	**-0.3345*** **(0.1610)**	-0.3854** (0.1566)
Inflation	-0.0983 (0.1203)	**-0.0112** **(0.0583)**	-0.0236 (0.0967)
Defense Expenditures (% of Gross Domestic Product)	-0.3781** (0.1350)	**-0.1604** **(0.1194)**	-0.1940 (0.1125)
Tax Revenues (% of Gross Domestic Product)	0.1035 (0.2678)	**0.3701** **(0.2752)**	0.3340 (0.2159)
Gross Domestic Product (Per Capita)	1.3496** (0.2413)	**1.8576**** **(0.4504)**	1.3934** (0.2996)
Total Population	-1.0034 (1.7257)	**-0.4595** **(1.3349)**	-0.7818 (1.3572)
Constant	-0.0345 (0.0233)		-0.0384 (0.0304)
df	243	**220**	243
R^2	0.1539	**0.5492**	0.1395

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. $N = 250$. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 14

Estimation Results for Sample Developing Countries

Gross Domestic Private Fixed Investment Per Capita with Expenditure Decentralization

Variable	IV Pooled	IV - Within One-Way Time Effects	IV - GLS One-Way Time Effects
Expenditure Decentralization	-0.0783 (0.0962)	**-0.1043** **(0.1055)**	-0.0961 (0.0941)
Inflation	-0.1744** (0.0512)	**-0.1776**** **(0.0743)**	-0.1773** (0.0503)
Defense Expenditures (% of Gross Domestic Product)	-0.1391+ (0.0787)	**-0.1475*** **(0.0745)**	-0.1427+ (0.0763)
Tax Revenues (% of Gross Domestic Product)	0.6926** (0.1765)	**0.5581*** **(0.2556)**	0.6155** (0.1713)
Gross Domestic Product (Per Capita)	1.4342** (0.2576)	**1.5585**** **(0.2745)**	1.4905** (0.2589)
Total Population	-1.6056* (0.7395)	**-0.8953** **(0.8198)**	-1.2156+ (0.7276)
Constant	-0.0288 (0.0247)		0.0118 (0.0315)
df	252	**230**	252
R^2	0.2319	**0.3581**	0.2297

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. $N = 259$. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 15

Estimation Results for Sample Developing Countries

Gross Domestic Private Fixed Investment Per Capita with Revenue Decentralization

Variable	IV Pooled	**IV - Within One-Way Time Effects**	IV - GLS One-Way Time Effects
Revenue Decentralization	-0.0421 (0.0932)	**-0.0277 (0.0825)**	-0.0408 (0.0979)
Inflation	-0.1737** (0.0514)	**-0.1767** (0.0760)**	-0.1760** (0.0501)
Defense Expenditures (% of Gross Domestic Product)	-0.1302+ (0.0784)	**-0.1361* (0.0718)**	-0.1310+ (0.0758)
Tax Revenues (% of Gross Domestic Product)	0.6670** (0.1762)	**0.5257** (0.2479)**	0.6094** (0.1727)
Gross Domestic Product (Per Capita)	1.4343** (0.2595)	**1.5651** (0.2780)**	1.4761** (0.2565)
Total Population	-1.5240* (0.7311)	**-0.7659 (0.8166)**	-1.2386+ (0.7158)
Constant	-0.0273 (0.0247)		0.0154 (0.0281)
df	252	**230**	252
R^2	0.2305	**0.3550**	0.2295

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. N = 259. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 16

Estimation Results for All Sample Countries

Gross Domestic Public Fixed Investment Per Capita with Expenditure Decentralization

Variable	IV Pooled	**IV Within Two-Way**	IV GLS Two-Way
Expenditure Decentralization	0.2084** (0.0840)	**0.2323**** **(0.0880)**	0.2221** (0.0859)
Inflation	-0.0253 (0.1963)	**-0.0274** **(0.0747)**	-0.0378 (0.0426)
Gross Domestic Product (Per Capita)	0.2676 (0.1964)	**1.3856**** **(0.5649)**	0.5131+ (0.2921)
Defense Expenditures (Per Capita)	0.5295** (0.0530)	**0.4381**** **(0.0667)**	0.4700** (0.0550)
Democratic Governance	-0.2510** (0.1051)	**-0.0264**** **(0.0097)**	-0.0289** (0.0109)
Tax Revenues (% of Gross Domestic Product)	0.1368 (0.1505)	**0.1551** **(0.2245)**	0.1744 (0.1548)
Constant	-0.0031 (0.0151)		-0.0005 (0.0359)
df	500	**434**	500
R^2	0.2371	**0.3744**	0.2371

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. $N = 507$. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 17

Estimation Results for All Sample Countries

Gross Domestic Public Fixed Investment Per Capita with Revenue Decentralization

Variable	IV Pooled	**IV Within Two-Way**	IV GLS Two-Way
Revenue Decentralization	-0.0144 (0.0823)	**-0.1141 (0.0901)**	-0.0111 (0.0825)
Inflation	-0.0406 (0.0417)	**-0.0328 (0.0751)**	-0.0420 (0.0412)
Gross Domestic Product (Per Capita)	0.2435 (0.1980)	**1.4133 (0.5774)**	0.1688 (0.2183)
Defense Expenditures (Per Capita)	0.5237** (0.0533)	**0.4254** (0.0678)**	0.5325** (0.0524)
Democratic Governance	-0.0258** (0.0106)	**-0.0270** (0.0098)**	-0.0263** (0.0106)
Tax Revenues (% of Gross Domestic Product)	0.1568 (0.1527)	**0.2162 (0.2156)**	0.1876 (0.1517)
Constant	-0.0048 (0.0152)		-0.0115 (0.0206)
df	500	**434**	500
R^2	0.2278	**0.3664**	0.2278

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. N = 507. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 18

Estimation Results for Sample Developed Countries

Gross Domestic Public Fixed Investment Per Capita with Expenditure Decentralization

Variable	IV Pooled	**IV - Within One-Way Time Effects**	IV - GLS One-Way Time Effects
Expenditure Decentralization	0.6972** (0.2068)	**0.4925* (0.2268)**	0.5761** (0.1985)
Inflation	-0.2448* (0.1162)	**-0.3134* (0.1470)**	-0.2870** (0.1128)
Gross Domestic Product (Per Capita)	-0.4458+ (0.2589)	**0.4770 (0.4830)**	-0.0291 (0.3129)
Defense Expenditures (Per Capita)	0.7701** (0.0798)	**0.5478** (0.0911)**	0.6452** (0.0882)
Democratic Governance	-0.4252+ (0.2497)	**-0.4586 (0.3415)**	-0.4582* (0.2379)
Tax Revenues (% of Gross Domestic Product)	-0.0778 (0.2652)	**0.0961 (0.2631)**	0.0777 (0.2576)
Constant	0.0412 (0.0197)		0.0207 (0.0252)
df	243	**220**	243
R^2	0.3125	**0.4560**	0.3125

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. *N* = 250. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 19

Estimation Results for Sample Developed Countries

Gross Domestic Public Fixed Investment Per Capita with Revenue Decentralization

Variable	IV Pooled	**IV - Within One-Way Time Effects**	IV - GLS One-Way Time Effects
Revenue Decentralization	0.1958 (0.2073)	**0.2157 (0.2337)**	0.1985 (0.1954)
Inflation	-0.2356* (0.1217)	**-0.2929* (0.1294)**	-0.2745** (0.1168)
Gross Domestic Product (Per Capita)	-0.4761+ (0.2654)	**0.4938 (0.4810)**	0.0182 (0.3292)
Defense Expenditures (Per Capita)	0.7448** (0.0819)	**0.5141** (0.0873)**	0.5984** (0.0936)
Democratic Governance	-0.4598+ (0.2563)	**-0.4915 (0.3749)**	-0.4912* (0.2419)
Tax Revenues (% of Gross Domestic Product)	0.0618 (0.2741)	**0.1656 (0.2536)**	0.1532 (0.2644)
Constant	-0.0431** (0.0201)		-0.0181 (0.0269)
df	243	**220**	243
R^2	0.2830	**0.4442**	0.2830

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. $N = 250$. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 20

Estimation Results for Sample Developing Countries

Gross Domestic Public Fixed Investment Per Capita with Expenditure Decentralization

Variable	IV Pooled	**IV Within Two-Way**	IV GLS Two-Way
Expenditure Decentralization	0.2062* (0.1089)	**0.1872*** **(0.0963)**	0.1908+ (0.1112)
Inflation	-0.0078 (0.0604)	**-0.0093** **(0.0950)**	-0.0148 (0.0619)
Gross Domestic Product (Per Capita)	0.6932* (0.3122)	**1.8453**** **(0.7292)**	0.9227* (0.3987)
Defense Expenditures (Per Capita)	0.4715** (0.0732)	**0.4061**** **(0.0770)**	0.4219** (0.0757)
Democratic Governance	-0.0221+ (0.0132)	**-0.0215*** **(0.0108)**	-0.0258* (0.0136)
Tax Revenues (% of Gross Domestic Product)	0.1720 (0.2013)	**0.1943** **(0.2673)**	0.2014 (0.2096)
Constant	-0.0107 (0.0226)		-0.0136 (0.0469)
df	252	**202**	252
R^2	0.2247	**0.4105**	0.2247

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. N = 259. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 21

Estimation Results for Sample Developing Countries

Gross Domestic Public Fixed Investment Per Capita with Revenue Decentralization

Variable	IV Pooled	**IV Within Two-Way**	IV GLS Two-Way
Revenue Decentralization	0.0172 (0.1077)	**0.0769** **(0.1016)**	0.0490 (0.1114)
Inflation	-0.0153 (0.0608)	**-0.0114** **(0.0958)**	-0.0184 (0.0622)
Gross Domestic Product (Per Capita)	0.6573* (0.3171)	**1.8424**** **(0.7535)**	0.8870* (0.4010)
Defense Expenditures (Per Capita)	0.4633** (0.0737)	**0.3932**** **(0.0782)**	0.4121** (0.0759)
Democratic Governance	-0.0229+ (0.0133)	**-0.0220*** **(0.0109)**	-0.0263* (0.0136)
Tax Revenues (% of Gross Domestic Product)	0.2022 (0.2044)	**0.2460** **(0.2575)**	0.2454 (0.2105)
Constant	-0.0101 (0.0228)		-0.0127 (0.0457)
df	252	**202**	252
R^2	0.2137	**0.4040**	0.2137

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. $N = 259$. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 22

Estimation Results for All Sample Countries

Inflation with Expenditure Decentralization

Variable	IV Pooled	**IV Within Two-Way**	IV GLS Two-Way
Expenditure Decentralization	-0.2608** (0.0933)	**-0.1623 (0.1025)**	-0.2105* (0.0932)
M2 (% of Gross Domestic Product)	0.1740 (0.2191)	**1.3128 (1.0947)**	0.1920 (0.2447)
Gross Domestic Product (Per Capita)	-1.2677** (0.3323)	**-2.8441* (1.4569)**	-1.7214** (0.4174)
Openness to International Trade (% of Gross Domestic Product)	-0.1939+ (0.1159)	**-0.0338 (0.2986)**	-0.1529 (0.1212)
Tax Revenues (% of Gross Domestic Product)	-0.0664 (0.1706)	**-0.0188 (0.1655)**	-0.0001 (0.1726)
Gross Domestic Savings (% of Gross Domestic Product)	0.0816+ (0.0456)	**0.0642* (0.0306)**	0.0691 (0.0457)
Constant	0.0501** (0.0191)		0.0681+ (0.0423)
df	452	**388**	452
R^2	0.0810	**0.2589**	0.0715

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. N = 459. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 23

Estimation Results for All Sample Countries

Inflation with Revenue Decentralization

Variable	IV Pooled	**IV Within Two-Way**	IV GLS Two-Way
Revenue Decentralization	-0.3089** (0.0895)	**-0.2566**** **(0.1089)**	-0.2859** (0.0901)
M2 (% of Gross Domestic Product)	0.1669 (0.2181)	**1.2501** **(1.0878)**	0.2001 (0.2435)
Gross Domestic Product (Per Capita)	-1.2743** (0.3308)	**-2.9351**** **(1.4601)**	-1.7833** (0.4157)
Openness to International Trade (% of Gross Domestic Product)	-0.2081+ (0.1152)	**-0.0299** **(0.2957)**	-0.1579 (0.1205)
Tax Revenues (% of Gross Domestic Product)	-0.1705 (0.1707)	**-0.0605** **(0.1701)**	-0.0903 (0.1720)
Gross Domestic Savings (% of Gross Domestic Product)	0.0844+ (0.0452)	**0.0665*** **(0.0287)**	0.0704 (0.0454)
Constant	0.0515** (0.0191)		0.0720+ (0.0420)
df	452	**388**	452
R^2	0.0891	**0.2666**	0.0786

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. N = 459. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 24

Estimation Results for Sample Developed Countries

Inflation with Expenditure Decentralization

Variable	IV Pooled	**IV - Within One-Way Country Effects**	IV - GLS One-Way Country Effects
Expenditure Decentralization	-0.0602 (0.1236)	**-0.0213 (0.1390)**	-0.0450 (0.1310)
M2 (% of Gross Domestic Product)	0.6103** (0.2581)	**1.3758** (1.2925)**	0.8092** (0.3184)
Gross Domestic Product (Per Capita)	-0.5451+ (0.3156)	**-1.4094 (1.4115)**	-0.7662* (0.3861)
Openness to International Trade (% of Gross Domestic Product)	0.3508** (0.1053)	**0.3400* (0.1750)**	0.3489** (0.1085)
Tax Revenues (% of Gross Domestic Product)	0.2361 (0.1704)	**0.1386 (0.1400)**	0.2173 (0.1800)
Gross Domestic Savings (% of Gross Domestic Product)	0.0920** (0.0278)	**0.0973* (0.0417)**	0.0937** (0.0285)
Constant	-0.0289* (0.0140)		-0.0318* (0.0165)
df	201	**188**	201
R^2	0.1048	**0.1281**	0.1020

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. *N* = 266. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 25

Estimation Results for Sample Developed Countries

Inflation with Revenue Decentralization

Variable	IV Pooled	**IV - Within One-Way Country Effects**	IV - GLS One-Way Country Effects
Revenue Decentralization	-0.3567 (0.1162)	**-0.4142^{+}** **(0.2637)**	-0.3797** (0.1253)
M2 (% of Gross Domestic Product)	0.5083* (0.2541)	**1.2586** **(1.2386)**	0.7216* (0.3198)
Gross Domestic Product (Per Capita)	-0.4297 (0.3109)	**-1.3045** **(1.3419)**	-0.6779^{+} (0.3878)
Openness to International Trade (% of Gross Domestic Product)	0.3492** (0.1028)	**0.3358*** **(0.1664)**	0.3458** (0.1056)
Tax Revenues (% of Gross Domestic Product)	0.1511 (0.1690)	**-0.0167** **(0.1597)**	0.0985 (0.1804)
Gross Domestic Savings (% of Gross Domestic Product)	0.0845** (0.0272)	**0.0869**** **(0.0365)**	0.0851** (0.0278)
Constant	-0.0249^{+} (0.0137)		-0.0267^{+} (0.0165)
df	201	**188**	201
R^2	0.1439	**0.1708**	0.1399

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. N = 266. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 26

Estimation Results for Sample Developing Countries

Inflation with Expenditure Decentralization

Variable	IV Pooled	**IV - Within One-Way Country Effects**	IV - GLS One-Way Country Effects
Expenditure Decentralization	-0.1075 (0.1092)	**-0.1041** **(0.0965)**	-0.1124 (0.1127)
M2 (% of Gross Domestic Product)	-0.2492 (0.2943)	**-0.2122** **(0.9248)**	-0.2481 (0.3786)
Gross Domestic Product (Per Capita)	-0.7039 (0.5147)	**-1.0517** **(1.4537)**	-0.7264 (0.6334)
Openness to International Trade (% of Gross Domestic Product)	0.3862** (0.1592)	**0.4337+** **(0.2668)**	0.4012** (0.1652)
Tax Revenues (% of Gross Domestic Product)	-0.5848 (0.2031)	**-0.0538** **(0.2102)**	-0.0447 (0.2105)
Gross Domestic savings (% of Gross Domestic Product)	0.0969 (0.0618)	**0.0980**** **(0.0310)**	0.0965 (0.0637)
Constant	0.0395 (0.0262)		-0.0320 (0.0400)
df	246	**218**	246
R^2	0.0892	**0.1683**	0.0884

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. $N = 300$. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 27

Estimation Results for Sample Developing Countries

Inflation with Revenue Decentralization

Variable	IV Pooled	**IV - Within One-Way Country Effects**	IV - GLS One-Way Country Effects
Revenue Decentralization	-0.1331 (0.1069)	**-0.1386+ (0.0808)**	-0.1419 (0.1122)
M2 (% of Gross Domestic Product)	-0.2297 (0.2949)	**0.2346 (0.9330)**	-0.2251 (0.3787)
Gross Domestic Product (Per Capita)	-0.7599 (0.5184)	**-1.1320 (1.4675)**	-0.7966 (0.6377)
Openness to International Trade (% of Gross Domestic Product)	0.3747** (0.1593)	**0.4281+ (0.2663)**	0.3917** (0.1652)
Tax Revenues (% of Gross Domestic Product)	-0.1063 (0.2044)	**-0.1021 (0.2070)**	-0.0955 (0.2113)
Gross Domestic savings (% of Gross Domestic Product)	-0.0991+ (0.0616)	**-0.1002** (0.0288)**	-0.0988 (0.0634)
Constant	-0.0397 (0.0261)		-0.0318 (0.0396)
df	246	**218**	246
R^2	0.0913	**0.1705**	0.0946

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. *N* = 300. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 28

Estimation Results for All Sample Countries

Democratic Governance with Expenditure Decentralization

Variable	Pooled Least Squares	**Within One-Way Country Effects**	GLS One-Way Country Effects
Expenditure Decentralization	-0.3836 (0.3193)	**-0.3015** **(0.3212)**	-0.3775 (0.3164)
Gross Domestic Product (Per Capita)	-0.2891 (0.2964)	**-0.0847** **(0.2482)**	-0.2545 (0.2941)
Openness to International Trade (% of Gross Domestic Product)	-1.0582** (0.0147)	**-1.3967** **(1.3042)**	-1.3222** (0.4286)
Defense Expenditures (% of Gross Domestic Product)	-0.4057 (0.2516)	**-0.3904** **(0.2610)**	-0.3999+ (0.2492)
Total Population	-2.5122 (2.1411)	**-1.0017** **(3.0803)**	-2.4596 (2.2408)
Constant	0.1309** (0.0552)		0.1356* (0.0604)
df	559	**533**	559
R^2	0.0237	**0.1298**	0.0237

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. $N = 565$. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 29

Estimation Results for All Sample Countries

Democratic Governance with Revenue Decentralization

Variable	Pooled Least Squares	**Within One-Way Country Effects**	GLS One-Way Country Effects
Revenue Decentralization	-0.1339 (0.3094)	**-0.0057** **(0.1792)**	-0.1195 (0.3068)
Gross Domestic Product (Per Capita)	-0.3069 (0.2975)	**-0.0902** **(0.2502)**	-0.2712 (0.2947)
Openness to International Trade (% of Gross Domestic Product)	-1.3147** (0.4333)	**-1.3991** **(1.3046)**	-1.3334** (0.4300)
Defense Expenditures (% of Gross Domestic Product)	-0.3613 (0.2489)	**-0.2410** **(0.2279)**	-0.3550 (0.2465)
Total Population	-2.2558 (2.2145)	**-0.3876** **(2.5513)**	-2.1720 (2.2416)
Constant	0.1299** (0.0555)		0.1337* (0.0607)
df	559	**533**	559
R^2	0.0215	**0.1284**	0.0215

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. *N* = 565. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 30

Estimation Results for Sample Developed Countries

Democratic Governance with Expenditure Decentralization

Variable	Pooled Least Squares	**Within One-Way Country Effects**	GLS One-Way Country Effects
Expenditure Decentralization	0.0626 (0.0590)	**-0.1129** **(0.1624)**	0.0581 (0.0556)
Gross Domestic Product (Per Capita)	-0.0786 (0.0282)	**-0.0276** **(0.0198)**	-0.0083 (0.0265)
Openness to International Trade (% of Gross Domestic Product)	0.0039 (0.0509)	**-0.0162** **(0.0461)**	0.0035 (0.0478)
Defense Expenditures (% of Gross Domestic Product)	0.0057 (0.0385)	**-0.0606** **(0.0717)**	0.0041 (0.0362)
Total Population	0.1913 (0.2562)	**-0.0900** **(0.3651)**	0.1876 (0.2416)
Constant	0.0049 (0.0043)		0.0050 (0.0040)
df	260	**245**	260
R^2	0.0100	**0.1750**	0.0100

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. $N = 266$. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 31

Estimation Results for Sample Developed Countries

Democratic Governance with Revenue Decentralization

Variable	Pooled Least Squares	**Within One-Way Country Effects**	GLS One-Way Country Effects
Revenue Decentralization	0.0504 (0.0540)	**-0.1086** **(0.1245)**	0.0468 (0.0509)
Gross Domestic Product (Per Capita)	-0.0054 (0.0284)	**-0.0334** **(0.0213)**	-0.0060 (0.0267)
Openness to International Trade (% of Gross Domestic Product)	0.0085 (0.0513)	**-0.0265** **(0.0493)**	0.0076 (0.0481)
Defense Expenditures (% of Gross Domestic Product)	0.0015 (0.0377)	**-0.0551** **(0.0569)**	-0.0001 (0.0354)
Total Population	0.1952 (0.2665)	**-0.1463** **(0.5045)**	0.1898 (0.2512)
Constant	0.0044 (0.0044)		0.0045 (0.0042)
df	260	**245**	260
R^2	0.0100	**0.1760**	0.0100

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. N = 266. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 32

Estimation Results for Sample Developing Countries

Democratic Governance with Expenditure Decentralization

Variable	Pooled Least Squares	**Within One-Way Country Effects**	GLS One-Way Country Effects
Expenditure Decentralization	-0.4714 (0.4538)	**-0.3181 (0.3444)**	-0.4016 (0.4596)
Gross Domestic Product (Per Capita)	-0.2384 (0.4803)	**-0.0258 (0.3156)**	-0.1358 (0.4915)
Openness to International Trade (% of Gross Domestic Product)	-1.6031** (0.6497)	**-1.6966 (1.5840)**	-1.6500** (0.6666)
Defense Expenditures (% of Gross Domestic Product)	-0.4509 (0.3633)	**-0.4225 (0.2901)**	-0.4208+ (0.3702)
Total Population	-4.7865 (3.3438)	**-1.1485 (3.2002)**	-3.2872 (3.7933)
Constant	0.2544* (0.1092)		0.2355+ (0.1468)
df	294	**266**	294
R^2	0.0327	**0.1321**	0.0327

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. *N* = 300. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 33

Estimation Results for Sample Developing Countries

Democratic Governance with Revenue Decentralization

Variable	Pooled Least Squares	**Within One-Way Country Effects**	GLS One-Way Country Effects
Revenue Decentralization	-0.1865 (0.4405)	**-0.0060** **(0.1994)**	-0.0945 (0.4481)
Gross Domestic Product (Per Capita)	-0.2728 (0.4805)	**-0.0392** **(0.3204)**	-0.1588 (0.4918)
Openness to International Trade (% of Gross Domestic Product)	-1.6192** (0.6527)	**-1.6990** **(1.5850)**	-1.6577** (0.6688)
Defense Expenditures (% of Gross Domestic Product)	-0.3949 (0.3596)	**-0.3811** **(0.2556)**	-0.3716 (0.3662)
Total Population	-4.3947 (3.3448)	**-0.4720** **(2.6321)**	-2.7927 (3.7884)
Constant	0.2495* (0.1096)		0.2275 (0.1476)
df	294	**266**	294
R^2	0.0297	**0.1306**	0.0297

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. N = 300. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 34

Estimation Results for All Sample Countries

Gini Coefficient

Variable	Pooled Least Squares	**Within Two-Way**	GLS Two-Way
Expenditure Decentralization	-0.0682 (0.1352)	**-0.1316** **(0.1359)**	-0.0476 (0.1403)
Gross Domestic Product	0.0506 (0.0517)	**0.2045*** **(0.0676)**	0.0931 (0.0586)
Gross Domestic Investment	-0.1296+ (0.0723)	**-0.0900** **(0.0588)**	-0.0954* (0.0729)
Openness to Trade	-0.0272 (0.0666)	**0.2411*** **(0.0945)**	0.0508 (0.0715)
Defense Expenditures	-0.1192+ (0.0710)	**-0.1031** **(0.0833)**	-0.1266+ (0.0771)
Health Expenditures	0.0314 (0.0548)	**0.1362*** **(0.0644)**	0.0622 (0.0560)
Constant	0.0531 (0.0711)		0.0086 (0.0128)
df	88	**56**	88
R^2	0.0823	**0.5267**	0.0447

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. *N* = 95. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 35

Estimation Results for All Sample Countries

Gini Coefficient

Variable	Pooled Least Squares	**Within Two-Way**	GLS Two-Way
Revenue Decentralization	-0.1090 (0.1075)	**-0.3294**** **(0.0715)**	-0.1696^{+} (0.1018)
Gross Domestic Product	-0.0500 (0.0508)	**0.1882**** **(0.0704)**	0.0771 (0.0534)
Gross Domestic Investment	-0.1513* (0.0681)	**-0.1243**** **(0.0497)**	-0.1263* (0.0641)
Openness to Trade	0.0087 (0.0692)	**0.1593** **(0.1039)**	0.0828 (0.0692)
Defense Expenditures	-0.1099^{+} (0.0686)	**-0.1023** **(0.0754)**	-0.1174^{+} (0.0677)
Health Expenditures	0.1606 (0.0539)	**-0.0954*** **(0.0478)**	0.0348 (0.0516)
Constant	0.0563 (0.0709)		0.0090 (0.0103)
df	88	**56**	88
R^2	0.0749	**0.5856**	0.0649

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. N = 95. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 36

Estimation Results for All Sample Countries

Gross Domestic Product Per Capita with Expenditure Decentralization

Variable	IV Pooled	**IV - Within Two-Way**	IV - GLS Two-Way
Expenditure Decentralization	0.0608 (0.0460)	**0.0660 (0.0506)**	0.0560 (0.0421)
Infant Mortality (Deaths per 1,000 Births)	-0.1638* (0.0778)	**-0.1527* (0.0771)**	-0.1714** (0.0730)
Inflation	-0.0709+ (0.0435)	**-0.0798* (0.0396)**	-0.0724+ (0.0416)
Gross Domestic Private Investment (Per Capita)	0.2672** (0.0683)	**0.6212** (0.1113)**	0.2814** (0.0700)
Gross Domestic Public Investment (Per Capita)	0.2568** (0.0676)	**0.2434** (0.1039)**	0.2088** (0.0679)
Democratic Governance	0.0094+ (0.0059)	**0.0109** (0.0039)**	0.0057 (0.0055)
Constant	0.0237** (0.0074)		0.0223 (0.0169)
df	504	**438**	504
R^2	0.1685	**0.4324**	0.1685

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. $N = 511$. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 37

Estimation Results for All Sample Countries

Gross Domestic Product Per Capita with Revenue Decentralization

Variable	IV Pooled	**IV - Within Two-Way**	IV - GLS Two-Way
Revenue Decentralization	-0.0189 (0.0446)	**-0.0469 (0.0532)**	0.0182 (0.0413)
Infant Mortality (Deaths per 1,000 Births)	-0.1747* (0.0779)	**-0.1531* (0.0773)**	-0.1774** (0.0731)
Inflation	-0.0731+ (0.0436)	**-0.0802* (0.0392)**	-0.0735+ (0.0416)
Gross Domestic Private Investment (Per Capita)	0.2632** (0.0684)	**0.6253** (0.1152)**	0.2777** (0.0699)
Gross Domestic Public Investment (Per Capita)	0.2540** (0.0679)	**0.2454** (0.1045)**	0.2086** (0.0678)
Democratic Governance	0.0092 (0.0069)	**0.0107** (0.0039)**	0.0054 (0.0054)
Constant	0.0234** (0.0074)		0.0224 (0.0169)
df	504	**438**	504
R^2	0.1656	**0.4308**	0.1656

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. $N = 511$. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 38

Estimation Results for Sample Developed Countries

Gross Domestic Product Per Capita with Expenditure Decentralization

Variable	IV Pooled	**IV - Within One-Way Time Effects**	IV - GLS One-Way Time Effects
Expenditure Decentralization	-0.1521 (0.1421)	**-0.2736** ** **(0.1305)**	-0.2602** (0.0991)
Infant Mortality (Deaths per 1,000 Births)	0.1000 (0.1092)	**0.0208** **(0.0770)**	0.0298 (0.0790)
Inflation	0.1445 (0.1353)	**0.0130** **(0.0842)**	0.0245 (0.0958)
Gross Domestic Private Investment (Per Capita)	0.4149** (0.1198)	**0.5950**** **(0.1492)**	0.5115** (0.1104)
Gross Domestic Public Investment (Per Capita)	0.4972* (0.1673)	**0.4133**** **(0.1339)**	0.3867** (0.1248)
Democratic Governance	-0.1129 (0.1709)	**-0.0353** **(0.0612)**	-0.0420 (0.1189)
Constant	0.0254** (0.0106)		0.0235** (0.0188)
df	241	**218**	241
R^2	0.1795	**0.6618**	0.1795

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. N = 248. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 39

Estimation Results for Sample Developed Countries

Gross Domestic Product Per Capita with Revenue Decentralization

Variable	IV Pooled	**IV - Within One-Way Time Effects**	IV - GLS One-Way Time Effects
Revenue Decentralization	-0.3351** (0.1336)	**-0.3141** (0.1159)**	-0.3172** (0.0928)
Infant Mortality (Deaths per 1,000 Births)	0.0752 (0.1086)	**0.0224 (0.0739)**	0.0277 (0.0781)
Inflation	0.0943 (0.1356)	**0.0199 (0.0930)**	0.0112 (0.0959)
Gross Domestic Private Investment (Per Capita)	0.4034** (0.1179)	**0.5767** (0.1483)**	0.5003** (0.1099)
Gross Domestic Public Investment (Per Capita)	0.5044** (0.1641)	**0.4068** (0.1322)**	0.3837** (0.1233)
Democratic Governance	-0.0743 (0.1697)	**-0.0027 (0.0840)**	-0.0085 (0.1181)
Constant	0.0258** (0.0150)		0.0258 (0.0189)
df	241	**218**	241
R^2	0.1965	**0.6674**	0.1965

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. N = 248. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 40

Estimation Results for Sample Developing Countries

Gross Domestic Product Per Capita with Expenditure Decentralization

Variable	IV Pooled	**IV - Within Two-Way**	IV - GLS Two-Way
Expenditure Decentralization	0.0555 (0.0547)	**0.0635 (0.0481)**	0.0393 (0.0527)
Infant Mortality (Deaths per 1,000 Births)	-0.2132 (0.1491)	**-0.4324**** **(0.1775)**	-0.3226* (0.1477)
Inflation	-0.1154^{+} (0.0637)	**-0.0989**$^{+}$ **(0.0526)**	-0.0768 (0.0632)
Gross Domestic Private Investment (Per Capita)	0.2163** (0.0912)	**0.6784**** **(0.1404)**	0.2693** (0.0917)
Gross Domestic Public Investment (Per Capita)	0.2036** (0.0833)	**0.1612 (0.1245)**	0.1527^{+} (0.0828)
Democratic Governance	0.0090 (0.0068)	**0.0117**** **(0.0041)**	0.0053 (0.0065)
Constant	0.0172 (0.0116)		0.0080 (0.0185)
df	258	**208**	258
R^2	0.1448	**0.4042**	0.1448

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. *N* = 265. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 41

Estimation Results for Sample Developing Countries

Gross Domestic Product Per Capita with Revenue Decentralization

Variable	IV Pooled	**IV - Within Two-Way**	IV - GLS Two-Way
Revenue Decentralization	-0.0015 (0.0535)	**-0.0510 (0.0533)**	-0.0041 (0.0517)
Infant Mortality (Deaths per 1,000 Births)	-0.2123 (0.1494)	**-0.4273**** **(0.1767)**	-0.3246* (0.1467)
Inflation	-0.1154+ (0.0639)	**-0.0974**+ **(0.0523)**	-0.0760 (0.0625)
Gross Domestic Private Investment (Per Capita)	0.2148** (0.0914)	**0.6851**** **(0.1453)**	0.2670** (0.0901)
Gross Domestic Public Investment (Per Capita)	0.1988** (0.0839)	**0.1608 (0.1249)**	0.1501+ (0.0818)
Democratic Governance	0.0869 (0.0679)	**0.0114**** **(0.0040)**	0.0050 (0.0065)
Constant	0.0172 (0.0117)		0.0087 (0.0181)
df	258	**208**	258
R^2	0.1413	**0.4028**	0.1413

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. *N* = 265. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 42

Growth Impact of Expenditure Decentralization

Full Sample

	Direct Effect of Expenditure Decentralization	Growth Effect of Variable	Growth Impact: Expenditure Decentralization
Expenditure Decentralization	---	0.0660	0.0109
Infant Mortality	-0.0078	-0.1527*	0.0002
Gross Domestic Private Investment	-0.0492	0.6212**	-0.0051
Gross Domestic Public Investment	0.2323**	0.2434**	0.0094**
Inflation	-0.1623	-0.0798*	0.0021
Democratic Governance	-0.3015	0.0109**	-0.0005
Sum (Significant Effects Only)			0.0094
One-standard Deviation for Expenditure Decentralization	0.1657		

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively.

Table 43

Growth Impact of Revenue Decentralization

Full Sample

	Direct Effect of Revenue Decentralization	Growth Effect of Variable	Growth Impact: Revenue Decentralization
Revenue Decentralization	---	-0.0469	-0.0079
Infant Mortality	-0.0033	-0.1531*	0.0001
Gross Domestic Private Investment	-0.0308	0.6253**	-0.0033
Gross Domestic Public Investment	-0.1141	0.2454**	-0.0047
Inflation	-0.2566**	-0.0802*	0.0035*
Democratic Governance	-0.0057	0.0107**	0.0000
Sum (Significant Effects Only)			0.0035
One-standard Deviation for Revenue Decentralization	0.1327		

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively.

Table 44

Growth Impact of Expenditure Decentralization

Developed Sample

	Direct Effect of Expenditure Decentralization	Growth Effect of Variable	Growth Impact: Expenditure Decentralization
Expenditure Decentralization	—	-0.2736**	-0.0370**
Infant Mortality	-0.1856*	0.0208	-0.0005
Gross Domestic Private Investment	0.0549	0.5950**	0.0044
Gross Domestic Public Investment	0.4925*	0.4133**	0.0276**
Inflation	-0.0213	0.0130	0.0000
Democratic Governance	-0.1129	-0.0353	0.0005
Sum (Significant Effects Only)			-0.0095
One-standard Deviation for Expenditure Decentralization	0.1354		

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively.

Table 45

Growth Impact of Revenue Decentralization

Developed Sample

	Direct Effect of Revenue Decentralization	Growth Effect of Variable	Growth Impact: Revenue Decentralization
Revenue Decentralization	---	-0.3141**	-0.0449**
Infant Mortality	-0.1395*	0.0224	-0.0004
Gross Domestic Private Investment	-0.3345*	0.5767**	-0.0275*
Gross Domestic Public Investment	0.2157	0.4068**	0.0125
Inflation	-0.4142	0.0199	-0.0012
Democratic Governance	-0.1086	-0.0027	0.0000
Sum (Significant Effects Only)			-0.0724
One-standard Deviation for Revenue Decentralization	0.1428		

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively.

Table 46

Growth Impact of Expenditure Decentralization

Developing Sample

	Direct Effect of Expenditure Decentralization	Growth Effect of Variable	Growth Impact: Expenditure Decentralization
Expenditure Decentralization	—	0.0635	0.0096
Infant Mortality	0.0012	-0.4324**	-0.0001
Gross Domestic Private Investment	-0.1043	0.6784**	-0.0107
Gross Domestic Public Investment	0.1872*	0.1612**	0.0046*
Inflation	-0.1041	-0.0989+	0.0016
Democratic Governance	-0.3181	0.0117**	-0.0006
Sum (Significant Effects Only)			0.0046
One-standard Deviation for Expenditure Decentralization	0.1511		

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively.

Table 47

Growth Impact of Revenue Decentralization

Developing Sample

	Direct Effect of Revenue Decentralization	Growth Effect of Variable	Growth Impact: Revenue Decentralization
Revenue Decentralization	---	-0.0510	-0.0077
Infant Mortality	-0.0002	-0.4273**	0.0000
Gross Domestic Private Investment Per Capita	-0.0277	0.6851**	-0.0028
Gross Domestic Public Investment	0.0769	0.1608	0.0019
Inflation	-0.1386+	-0.0974+	0.0020+
Democratic Governance	-0.0060	0.0114**	0.0000
Sum (Significant Effects Only)			0.0020
One-standard Deviation for Revenue Decentralization	0.1501		

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively.

CHAPTER SIX

CONCLUSIONS, RECOMMENDATIONS, AND FUTURE RESEARCH

Introduction

In this dissertation, we have accomplished several items worth noting. First, we have developed theoretical model of fiscal decentralization that incorporates the hypothesized direct and indirect effects of fiscal decentralization on growth in per capita income. We developed, for the first time in the literature, a theoretical model of fiscal decentralization that explicitly incorporates the more conventional effects of decentralization on economic efficiency, interjurisdictional equality in the distribution of public resources, macroeconomic stability, and democratic governance, within a model of decentralization and economic growth. Second, we have conducted an empirical analysis of the hypothesized effects of fiscal decentralization. We empirically examined whether these hypothesized indirect and direct effects of fiscal decentralization significantly influence per capita income growth and the sign, significance, and magnitude of the hypothesized effects. Third, we have, for the first time in the literature, examined the long-run influence of fiscal decentralization on growth in per capita income. Fourth, we noted the absence of tradeoffs among the direct and indirect effects of fiscal decentralization on per capita income growth, even though our theoretical model of economic growth suggested such tradeoffs might exist.

In Chapter Two of this dissertation, we reviewed the fiscal decentralization literature. We examined the definitions of fiscal decentralization and discussed the literature on the relationship between fiscal decentralization and economic efficiency, disparities in the distribution of public and private resources, macroeconomic stability, and democratic governance. Next, we presented a review of the literature on the relationship, both indirect and direct, between fiscal decentralization and economic growth. We concluded Chapter Two with a discussion of the literature on the tradeoffs associated with fiscal decentralization.

In Chapter Three we developed an augmented neoclassical model of economic growth that incorporated the direct and indirect effects of fiscal decentralization. Following Mankiw, Romer, and Weil (1992), we expanded the exogenous technological progress term to include the potential effects of fiscal decentralization on macroeconomic stability, equality in the distribution of subnational fiscal resources, and democratic governance. We illustrated how fiscal decentralization may also indirectly affect economic output through its influence on physical and human capital. We then observed that decentralization may affect the convergence path to the steady-state growth rate through two channels: a direct effect on economic growth and a series of indirect effects through its influence on physical and human capital, macroeconomic stability, horizontal fiscal disparities, and democratic governance. From the theoretical model we developed seven testable hypotheses concerning the relationship between fiscal decentralization, its outcomes, and economic growth.

In Chapter Four we discussed the data sources used to estimate the hypotheses developed in Chapter Three and developed the empirical framework within which we would estimate the influence of fiscal decentralization in Chapter Five. We noted the random effects estimator would be preferred method of estimating the influence of fiscal decentralization in the presence of homoscedastic disturbances, no serial correlation, independence of the effects and the regressors, and a balanced panel. On the other hand, we noted that the Within estimator was consistent in the presence of heteroscedastic and serially correlated disturbances and was not dependent upon the assumption of the independence of the effects and the regressors. Given the potential problems associated with estimating the feasible GLS variance-covariance matrix in the presence of an unbalanced panel, we concluded that the Within estimator was the most appropriate estimator for the investigation of the influence of fiscal decentralization.

We opened Chapter Five by testing for the presence of serial correlation, endogeneity, and heteroscedasticity. While we found that the disturbances for the estimation equations estimated in levels were serially correlated, we observed that the disturbances for the estimation equations estimated in first differences were stationary. We also determined that the pooled LS and Within residuals were heteroscedastic. We used White's (1980) heteroscedastic consistent variance-covariance estimator to correct the estimated standard errors for the presence of heteroscedasticity. We then estimated the impact of fiscal decentralization on the seven dependent variables of interest, finding support for the hypotheses that decentralization significantly influences the accumulation of public capital and the inflation rate for the countries in the sample. We also noted empirical support for the hypothesis for a direct relationship between fiscal decentralization and economic growth for the developed countries in the sample. In the last section of Chapter Five we calculated the static long-term growth impacts of fiscal decentralization. We estimated that the static impact of fiscal decentralization on economic growth was positive for the developing countries in the sample and negative for the developed countries in the sample. We concluded Chapter Five with an examination of the hypothesized tradeoffs among the outcomes of fiscal decentralization, finding little empirical support for the hypothesized tradeoffs.

Results of the Work

In this section, we briefly discuss the main results of this course of research. The first result of this dissertation is the development of a neoclassical model of economic growth that explicitly includes the indirect effects of fiscal decentralization within a model of economic growth. We believe that this model represents a significant improvement over previous theoretical models of fiscal decentralization in that we do not impose a priori restrictions on the preferences of agents in the economy through the use of a representative agent model. Unlike previous models of fiscal decentralization, we allow for fiscal decentralization to influence economic growth through a direct effect on output and through a series of indirect effects. We show that the convergence growth path to the state steady economy is dependent upon the direct and indirect effects of fiscal decentralization.

We believe that the second result of this course of research is the development of an empirical methodology to investigate the indirect and direct effects of fiscal decentralization on economic growth. The empirical methodology developed in this dissertation can be used to examine the influence of fiscal decentralization in one or many countries and can be extended to include other socio-economic variables of interest. The empirical framework is the first in the literature to explicitly include and estimate the indirect effects of fiscal decentralization on economic growth. We have shown that many of the previous studies of fiscal decentralization have failed to explicitly control for serial correlation, endogeneity, and for the Levine-Renelt determinants of economic growth.

Four empirical results emerge from the analysis. First, we noted in Chapter Five that expenditure decentralization appears to increase the rate of public capital accumulation for the full, developed, and developing country samples. Second, we observed that revenue decentralization appears to lower the rate of inflation for the full, developed, and developing country samples. We believe that the first result suggests that fiscal decentralization creates incentives for public capital accumulation by subnational governments. The second result is striking in that it appears to refute the arguments of Prud'homme (1995), Tanzi (1996, 2000), and others that have suggested that decentralization, at a minimum, presents an obstacle to achieving macroeconomic stability. The third result appears to support the contention that the impact of fiscal decentralization is dependent upon the level of development. While we found that expenditure decentralization increases the rate of public investment and revenue decentralization lowers the rate of inflation, we did not find any other statistically significant relationship for the full or developing country samples. We did, however, find that decentralization appears to lower the rate of infant mortality and have a direct, negative impact on economic growth for the developed countries in the sample. We also found that revenue decentralization appears to lower the rate of private investment for the developed countries in the sample. These results suggest that the tradeoffs of decentralization, if any, are present for the developed, and not developing, countries in the sample.

The third result of this dissertation is the investigation of the aggregate influence of fiscal decentralization on economic growth. We believe that this is one of the first analyses of the indirect and direct effects of fiscal decentralization on economic growth. Following Dollar and Kraay's (2000) methodology, we examined the static long-term growth impact of fiscal decentralization and noted that the overall impact of decentralization appears to be small in magnitude. We estimated that the aggregate static growth impact of decentralization is negative for the sub-sample of developed countries and positive for the sub-sample of developing and transitional countries. These results suggest that the aggregate effect of decentralization may be dependent upon the level of development, with the sign of the relationship being positive for developing and transitional countries and negative for developed countries. We caution that this result is the first investigation of the aggregate influence of decentralization and further examination of this issue is warranted before we can make any firm conclusions on the nature of the relationship between the aggregate static effect of fiscal decentralization and growth in per capita GDP.

The final empirical result of this dissertation is the apparent lack of tradeoffs among the outcomes of fiscal decentralization. While we found the existence of outcomes that were common to the developed and developing country sub-samples (the positive influence of decentralization on public investment and the negative influence of decentralization on inflation), these effects are complementary, that is, they each induce higher rates of economic growth. For the developed sample of countries, however, we did note the appearance of a statistically significant tradeoff with respect to expenditure decentralization. Expenditure decentralization appears to directly and significantly depress per capita GDP growth while indirectly and positively influencing per capita GDP growth through increased public investment. The overall effect appears to be a slight reduction in long-term per capita GDP growth. Revenue decentralization, on the other hand, negatively influences per capita GDP growth through its direct effect and its indirect effect on private investment. As noted in Chapter Five, we do not believe that our failure to find tradeoffs among the outcomes of fiscal decentralization is a sign that these tradeoffs do not exist but that the process of decentralization may be more diffuse than originally thought and that further analysis of this issue may reveal the hypothesized tradeoffs. We believe that as future research adds to the breadth and depth of the panel data set, further analysis of this issue will reveal the hypothesized tradeoffs. Unfortunately, given the data limitations of the current panel data set, we must leave this question for future research.

Fiscal Decentralization Policy

What policy guidance can be drawn from this course of research? We have noted the lack of empirical support for the argument in the literature that fiscal decentralization presents another obstacle to achieving macroeconomic stability for the developing and transitional countries in the sample. We have also observed the lack of empirical support for the proposition that fiscal decentralization will, due to the lack of capacity (or capability) of subnational governments, result in decreased technical efficiency. We have, on the other hand, observed that expenditure decentralization promotes the accumulation of public investment and lowers the rate of inflation for the countries in the sample. From these results, we can offer some policy guidance.

First, there appears to be no a priori rationale for fiscal decentralization to cause macroeconomic instability. We agree with the consensus in the literature that poorly designed or implemented fiscal decentralization programs can result in macroeconomic stability, however, there does not appear to be justification for the argument that decentralization per se causes macroeconomic instability. Curiously, what most point to as an example of decentralization gone awry, the crises in Argentina and Brazil during the late 1980s and early 1990s, may not be attributed to decentralization policies. Easterly (2000) finds that, in general, economic and fiscal policies improved during this period for the countries in this region and that economic shocks, not poor policies, were to blame for the debt crises and recessions of this period. In fact, the empirical evidence appears to support the argument that decentralization allows asymmetric responses to macroeconomic shocks, enhancing, not degrading macroeconomic stability.

Second, fiscal decentralization appears to promote public investment. Decentralization may create incentives for subnational public officials to increase revenue mobilization and investment. Decentralization may also reduce the leakages in the tax-expenditure system, increasing resources available for public investment. This result suggests that an appropriate mechanism to increase public investment, even for those countries where revenue mobilization is low, is to increase the level of fiscal decentralization. It may be that the reallocation of resources and authority to subnational governments increases the transparency of government operations, strengthening the connection between taxes paid and services received.

Third, the case for fiscal decentralization strengthening democratic governance may be overstated. As we pointed out in Chapters Two and Four, many of the recent studies purporting to find a significant relationship between democratic governance and economic growth have suffered from the same failures as some of the more recent studies of fiscal decentralization, that is, failure to examine and properly control for serial correlation, endogeneity, and to condition the parameter estimates. We believe that what these studies have found, at best, may be a degree of association between governance, decentralization, and growth. Governance and decentralization, as we have found in this decentralization, do not appear to be causally related. We caution that this result may be dependent upon the countries in the sample and that more research on this issue is warranted.

The Need for Future Research

While we have accomplished the objectives of the dissertation set forth in Chapter One, we believe that this course of research has highlighted the need for future research into the outcomes of fiscal decentralization and the potential tradeoffs among these outcomes. First, while we have constructed the first theoretical model in the literature to explicitly incorporate the potential indirect outcomes of fiscal decentralization in a model of economic growth, the model should be expanded to include the determinants of fiscal decentralization and the explicit inclusion of heterogenous agents. Second, while we have constructed one of the largest panel data sets to date for the empirical examination of the influence of fiscal decentralization, we were limited in our empirical analysis due to the lack of several key variables. We believe that securing these variables, to include data on horizontal fiscal equalities and more information on public good outcomes, would greatly enhance our ability to conduct the empirical analysis of the outcomes of fiscal decentralization. Finally, while we have conducted the first analysis in the literature on the tradeoffs among the outcomes of fiscal decentralization, we believe that more analysis of this issue is warranted at a greater level of dissaggregation.

Turning first to the issue of the theoretical model, we believe that while we have constructed the first theoretical model in the literature to explicitly include the indirect outcomes of fiscal decentralization in a neoclassical model of economic growth, the theoretical model can be refined in the future to include the determinants of fiscal decentralization and the influence of decentralization on the heterogenous agents in the economy. We have explicitly subsumed the determinants of fiscal decentralization in the construction of the neoclassical growth model and we believe that the modification of the theoretical model to include the interaction of the determinants and outcomes of fiscal decentralization would produce insight into the process of fiscal decentralization. We have also subsumed the consumption side of the economy to avoid the pitfall of the representative agent approach that has detracted from the results of the more recent studies in the literature. While the current model does not place explicit restrictions on the preferences of agents in the economy, we believe that the inclusion of heterogenous agents in the model would provide insight into the impact of fiscal decentralization on the consumption and savings decisions of these agents.

As we have noted throughout this dissertation, we were limited in our analysis of the outcomes of fiscal decentralization due to the lack of panel data for several key socio-economic variables, to include horizontal fiscal equities, education outcomes, and investment behavior. The lack of timely updates to the *Government Finance Statistics* database has presented a continuing problem to the conduct of the proposed line of research. Future research should focus on expanding the number of socio-economic variables in the panel data set and constructing a multi-dimensional measure of fiscal decentralization. Future research should also include the determinants of fiscal decentralization in the panel data set to allow the analysis of the relationships between the determinants and outcomes of fiscal decentralization and economic growth. We believe that the construction of individual country panel data sets may be necessary to accurately gauge the influence of fiscal decentralization on a country-by-country basis.

We believe that the inclusion of new regressors and the balancing of the panel data set with additional observations would enhance the empirical analysis of the outcomes of fiscal decentralization. By including new regressors in the panel data set, future research would be able to refine the existing estimation equations and examine other possible tradeoffs among the hypothesized outcomes of fiscal decentralization. We note that the panel data set should be balanced, not by eliminating countries or by shortening the time span of the data set, but through the addition of new observations. By balancing the panel data set of fiscal decentralization, future researchers would be able to employ the random effects GLS estimator, which, as noted in Chapter Four, would allow the inclusion of time and individual invariant regressors in the estimation equations. Using a random effects GLS estimator would allow future researchers to examine the interaction between the time and individual invariant determinants of fiscal decentralization and the time and individual varying outcomes of fiscal decentralization.

In conclusion, we recognize that while we have accomplished the objective of the dissertation, much work remains to be done with respect to outcomes of fiscal decentralization. We note that much work needs to be done on the construction of a multi-dimensional measure of fiscal decentralization and that the theoretical model developed in this dissertation should be refined to include heterogenous agents. While we have presented the first empirical examination in the literature of the indirect influences of fiscal decentralization on economic growth and the potential tradeoffs among these outcomes, we recognize that significant work remains to be done in this area. The construction of a balanced panel data set will allow the inclusion of time and individual-invariant regressors in the empirical analysis. The inclusion of additional regressors is necessary to refine the empirical analysis and to examine those empirical questions we have left unaddressed due to the absence of key socio-economic variables. We would argue that these steps are necessary to examine the interaction between the determinants and outcomes of fiscal decentralization, an objective that we believe should an objective of the next course of research into the topic of fiscal decentralization. We leave these to future research.

APPENDIX A

THEORETICAL APPENDIX

Following Mankiw et al. (1992), we employ an augmented Solow (1956) neoclassical model of economic growth that includes the accumulation of human as well as physical capital to examine the influence of fiscal decentralization. We augment the model by explicitly differentiating between public and private capital in the production function. We also augment the model by assuming that the standard term for technological progress can be disaggregated into exogenous technical progress and the direct and indirect effects of fiscal decentralization. We assume a Cobb-Douglas production function for the entire economy, so production at time *t* is given by

$$
\begin{gathered}
Y(t) = A(t)\, K(t)^{\alpha}\, H(t)^{\beta}\, G(t)^{\psi}\, L(t)^{\theta} \\
\alpha > 0,\ \beta > 0,\ \psi > 0,\ \theta > 0 \\
\alpha + \beta + \psi + \theta \geq 1
\end{gathered}
\tag{33}
$$

where *Y(t)* is output, *A(t)* is the level of technology and other institutional factors, including fiscal decentralization, *L(t)* is labor force participation, and *K(t)*, *H(t)*, and *G(t)* are the stocks of private, human, and public capital at time *t*, respectively. Let *T* be the level of technology, *D* the level of fiscal decentralization, *MS* the level of macroeconomic stability, *IJ* the level of interjurisdictional equality in the distribution of public resources, and *Gov* the level of democratic governance. We define *A(t)* as the product of the level of technology and other institutional factors at time *t* or

$$A(t) = T(t)\, D(t)\, MS(t)\, IJ(t)\, Gov(t) \tag{34}$$

We further assume that *L* and *T* grow exogenously at rates *n* and *g*, respectively and that all forms of reproducible capital depreciate at the uniform rate of δ.

We then assume that macroeconomic stability, interjurisdictional equality in the distribution of public resources, and democratic governance are functions of, among other things, fiscal decentralization or

$$\begin{aligned} MS(t) &= g(D(t), X^1(t)) \\ IJ(t) &= h(D(t), X^2(t)) \\ GOV(t) &= i(D(t), X^3(t)) \end{aligned} \tag{35}$$

where $X^i(t)$ (i = 1,..,3) are vectors of other exogenous variables explaining the behavior of the three variables of interest. For simplicity, we assume that decentralization in uncorrelated with the $X^i(t)$.

Using (33), (34), and (35), and the assumption that fiscal decentralization is not correlated with the other inputs in the production functions in Equation (35), the first order derivative of output with respect to fiscal decentralization is

$$\begin{aligned} \frac{dY(t)}{dD(t)} = \frac{dA(t)}{dD(t)} &+ \alpha K(t)^{\alpha-1} \frac{dK(t)}{dD(t)} + \beta H(t)^{\beta-1} \frac{dH(t)}{dD(t)} \\ &+ \psi G(t)^{\psi-1} \frac{dG(t)}{dD(t)} + \theta L(t)^{\theta-1} \frac{dL(t)}{dD(t)} \end{aligned} \tag{36}$$

Reorganizing terms yields

$$\frac{dY(t)}{dD(t)} = \frac{dA(t)}{dD(t)} + \alpha \frac{Y(t)}{K(t)} \frac{dK(t)}{dD(t)} + \beta \frac{Y(t)}{H(t)} \frac{dH(t)}{dD(t)} + \psi \frac{Y(t)}{G(t)} \frac{dG(t)}{dD(t)} + \theta \frac{Y(t)}{L(t)} \frac{dL(t)}{dD(t)} \tag{37}$$

The derivative of *A(t)* with respect to fiscal decentralization is then

$$\frac{dA(t)}{dD(t)} = \frac{dA(t)}{dD(t)} \frac{dD(t)}{dD(t)} + \frac{dA(t)}{dMS(t)} \frac{dMS(t)}{dD(t)} + \frac{dA(t)}{dIJ(t)} \frac{dIJ(t)}{dD(t)} + \frac{dA(t)}{dGov(t)} \frac{dGov(t)}{dD(t)} \tag{38}$$

Reorganizing terms

$$\frac{dA(t)}{dD(t)} = \frac{A(t)}{D(t)} + \frac{A(t)}{MS(t)} \frac{dMS(t)}{dD(t)} + \frac{A(t)}{IJ(t)} \frac{dIJ(t)}{dD(t)} + \frac{A(t)}{Gov(t)} \frac{dGov(t)}{dD(t)} \tag{39}$$

yields

$$\frac{dA(t)}{dD(t)} = A(t) \left[\frac{1}{D(t)} + \frac{MS_D}{MS(t)} + \frac{IJ_D}{IJ(t)} + \frac{Gov_D}{Gov(t)} \right] \tag{40}$$

Combining (37) and (40) produces Equation (4)

$$\frac{dY(t)}{dD(t)} = A(t) \left[\frac{1}{D(t)} + \frac{MS_D}{MS(t)} + \frac{IJ_D}{IJ(t)} + \frac{Gov_D}{Gov(t)} \right] Y(t) \left[\alpha \frac{K_D}{K(t)} + \beta \frac{H_D}{H(t)} + \psi \frac{G_D}{G(t)} + \theta \frac{L_D}{L(t)} \right] \tag{41}$$

Multiply by *D(t) / D(t)* and reorganizing terms yields Equation (5)

$$e_{Y,D} = A(t)\,[\,1 + e_{MK,D} + e_{IJ,D} + e_{GOV,D}\,][\,\alpha\, e_{K,D} + \beta\, e_{H,D} + \psi\, e_{G,D} + \theta\, e_{I,D}\,] \quad (42)$$

Defining i_k , i_h , and i_g as the fractions of income invested in private, human, and public capital, respectively; $k(t) = K(t)/L(t)$, $h = H(t)/L(t)$, and $g(t) = G(t)/L(t)$ as the stocks of private, human, and public capital per unit of labor; and assuming that the same production function applies to all forms of reproducible capital and consumption, then the growth of the economy over time is given by

$$\begin{aligned} \dot{k}(t) &= i_k\, y(t) - (n + g + \delta)\, k(t) \\ \dot{h}(t) &= i_k\, y(t) - (n + g + \delta)\, h(t) \\ \dot{g}(t) &= i_g\, y(t) - (n + g + \delta)\, g(t) \end{aligned} \quad (43)$$

Assuming decreasing returns to scale for all forms of reproducible capital and that no combination of reproducible capital has constant returns to scale, the evolution of per-capita private capital stock over time is governed by

$$\begin{aligned} \dot{k}(t) &= i_k\, y(t) - (n + g + \delta)\, k(t) \\ \dot{k}(t) &= i_k\, k(t)^{\alpha}\, h(t)^{\beta}\, g(t)^{\psi} - (n + g + \delta)\, k(t) \end{aligned} \quad (44)$$

At the steady-state, the change in the rate of accumulation of per-capita private capital is zero, so Equation (44) can be restated as

$$i_k\, k^*(t)^{\alpha}\, h^*(t)^{\beta}\, g^*(t)^{\psi} = (n + g + \delta)\, k^*(t) \quad (45)$$

where k^* , h^*, and g^* represent the steady-state levels of private, human, and public capital, respectively. Noting that $h^*(t) = (i_h / i_k)\, k^*(t)$ and $g^*(t) = (i_g / i_k)\, k^*(t)$, we can restate (45) as

$$i_k\, k^*(t)^{\alpha} \left(\frac{i_h}{i_k}\right) k^*(t)^{\beta} \left(\frac{i_g}{i_k}\right) k^*(t)^{\psi} = (n + g + \delta)\, k^*(t) \qquad \textbf{(46)}$$

reorganizing (46) results in

$$\frac{i_k}{i_k^{\beta} + i_k^{\psi}}\, k^*(t)^{\alpha}\, k^*(t)^{\beta}\, k^*(t)^{\psi}\, i_h^{\beta}\, i_g^{\psi} = (n + g + \delta)\, k^*(t) \qquad \textbf{(47)}$$

simplifying (47) and solving for $k^*(t)$ results in

$$k^*(t) = \left[\frac{i_k^{1-\beta-\psi}\, i_h^{\beta}\, i_g^{\psi}}{n + g + \delta}\right]^{\frac{1}{1-\alpha-\beta-\psi}} \qquad \textbf{(48)}$$

By similar process, we can solve for the steady-state stocks for human capital

$$h^*(t) = \left[\frac{i_h^{1-\alpha-\psi}\, i_k^{\alpha}\, i_g^{\psi}}{n + g + \delta}\right]^{\frac{1}{1-\alpha-\beta-\psi}} \qquad \textbf{(49)}$$

and public capital

$$g^*(t) = \left[\frac{i_g^{1-\alpha-\beta}\, i_k^{\alpha}\, i_h^{\beta}}{n + g + \delta}\right]^{\frac{1}{1-\alpha-\beta-\psi}} \qquad \textbf{(50)}$$

Substituting (48), (49), and (50) into the production function yields

$$Y^{*}(t) = A(t)\,k^{*}(t)\left[\frac{\dot{i}_k^{\,1-\beta-\psi}\,\dot{i}_h^{\,\beta}\,\dot{i}_g^{\,\psi}}{n+g+\delta}\right]^{\frac{\alpha}{1-\alpha-\beta-\psi}}\left[\frac{\dot{i}_h^{\,1-\alpha-\psi}\,\dot{i}_k^{\,\alpha}\,\dot{i}_g^{\,\psi}}{n+g+\delta}\right]^{\frac{\beta}{1-\alpha-\beta-\psi}} \left[\frac{\dot{i}_g^{\,1-\alpha-\beta}\,\dot{i}_k^{\,\alpha}\,\dot{i}_h^{\,\beta}}{n+g+\delta}\right]^{\frac{1}{\psi-\alpha-\beta-\psi}} L(t)^{\theta} \tag{51}$$

Dividing by $L(t)$ and reorganizing (51)

$$y^{*}(t) = A(t)\left(\frac{1}{n+g+\delta}\right)^{\frac{\alpha+\beta+\psi}{1-\alpha-\beta-\psi}}\left(\dot{i}_k^{\,1-\beta-\psi}\,\dot{i}_h^{\,\beta}\,\dot{i}_g^{\,\psi}\right)^{\frac{\alpha}{1-\alpha-\beta-\psi}} \left(\dot{i}_h^{\,1-\alpha-\psi}\,\dot{i}_k^{\,\alpha}\,\dot{i}_g^{\,\psi}\right)^{\frac{\beta}{1-\alpha-\beta-\psi}}\left(\dot{i}_g^{\,1-\alpha-\beta}\,\dot{i}_k^{\,\alpha}\,\dot{i}_h^{\,\beta}\right)^{\frac{\psi}{1-\alpha-\beta-\psi}} \tag{52}$$

Grouping like terms

$$y^{*}(t) = A(t)\left(\frac{1}{n+g+\delta}\right)^{\frac{\alpha+\beta+\psi}{1-\alpha+\beta+\psi}}\left(\dot{i}_k^{\,\alpha-\alpha\beta-\alpha\psi}\,\dot{i}_k^{\,\alpha\beta}\,\dot{i}_k^{\,\alpha\psi}\right)^{\frac{1}{1-\alpha+\beta+\psi}} \left(\dot{i}_h^{\,\beta-\alpha\beta-\beta\psi}\,\dot{i}_h^{\,\alpha\beta}\,\dot{i}_h^{\,\beta\psi}\right)^{\frac{1}{1-\alpha+\beta+\psi}} \left(\dot{i}_g^{\,\psi-\alpha\psi-\beta\psi}\,\dot{i}_g^{\,\alpha\psi}\,\dot{i}_g^{\,\beta\psi}\right)^{\frac{1}{1-\alpha+\beta+\psi}} \tag{53}$$

yields Equation (10)

$$y^{*}(t) = A(t)\, k^{*}(t) \left[\frac{i_k^{1-\beta-\psi}\, i_h^{\beta}\, i_g^{\psi}}{n+g+\delta} \right]^{\frac{\alpha}{1-\alpha-\beta-\psi}} \left[\frac{i_h^{1-\alpha-\psi}\, i_k^{\alpha}\, i_g^{\psi}}{n+g+\delta} \right]^{\frac{\beta}{1-\alpha-\beta-\psi}} \left[\frac{i_g^{1-\alpha-\beta}\, i_k^{\alpha}\, i_h^{\beta}}{n+g+\delta} \right]^{\frac{1}{\psi-\alpha-\beta-\psi}} \quad \textbf{(54)}$$

Expanding *A(t)* and taking the natural logarithm of (54) produces Equation (10)

$$\begin{aligned} \ln y^{*}(t) = {} & \ln T(t) + \ln D(t) + \ln MS(t) + \ln IJ(t) + \ln Gov(t) \\ & - \frac{\alpha+\beta+\psi}{1-\alpha+\beta+\psi} \ln(n+g+\delta) + \frac{\alpha}{1-\alpha+\beta+\psi} \ln i_k \\ & + \frac{\beta}{1-\alpha+\beta+\psi} \ln i_h + \frac{\psi}{1-\alpha+\beta+\psi} \ln i_g \end{aligned} \quad \textbf{(55)}$$

APPENDIX B

VARIABLE APPENDIX

1. $RevDec_{i\,t}$ = Revenue Decentralization

   : Ratio of total subnational government revenues, including grants and transfers, to the sum of government revenues at the subnational and central government level

   : Government Finance Statistics (1999)

2. $ExpDec_{i\,t}$ = Expenditure Decentralization

   : Ratio of total subnational expenditures to the sum of total expenditures at the subnational and central government levels

   : Government Finance Statistics (1999)

3. $H_{i\,t}$ = Infant Mortality per 1,000 Live Births

   : Number of deaths of children under the age of 1 per 1,000 live births

   : IDB (2000)

4. $K_{i\,t}$ = Gross Domestic Private Fixed Investment Per Capita

   : Expressed in Constant U.S. Dollars

   : World Development Indicators (2000)

5. $G_{i\,t}$ = Gross Domestic Public Fixed Investment Per Capita

: Expressed in Constant U.S. Dollars

: World Development Indicators (2000)

6. $MS_{i\,t}$ = Macroeconomic Stabiltiy

: Period-to-Period Change in the Consumer Price Index

: World Development Indicators (2000)

7. $DEM_{i\,t}$ = Democratic Governance

: (14 - political rights index - civil liberties index) / 12

: The political rights index measures the ability of citizens to form political parties that represent a significant range of voter choice and where political candidates openly compete for and are elected to positions in government. The political rights index ranges from 1 (full political rights) to 7 (absence of political rights).

: The civil liberties index measures whether a country respects and protects individuals' ethnic, economic, linguistic, religious, and other rights, include freedom of association and press. The civil liberties index ranges from 1 (full respect and protection of civil liberties) to 7 (absence of civil liberties).

: The composite democratic governance index ranges from 0 (complete absence of civil liberties and political rights) to 1 (full political rights and respect and protection of civil liberties).

: Freedom House (1999)

8. $Gini_{i\,t}$ = Gini Coefficient

: Deininger and Squire (1996)

9. $y_{i\,t}$ = Gross Domestic Product Per Capita

: Express in constant United States Dollars

: World Development Indicators (2000)

10. $Urban_{i\,t}$ = Urbanization

: The percent of total population living in urban settings.

: World Development Indicators (2000)

11. $HEXP_{i\,t}$ = Health Expenditures Per Capita

: The ratio of total health care expenditures at all levels of government to total population.

: Expressed in United States Dollars

: Government Finance Statistics (1999) (Health Expenditures)

: IDB (2000) (Total Population)

12. $DEF_{i\,t}$ = Defense Expenditures Per Capita

: The ratio of total defense expenditures at all levels of government to total population.

: Expressed in United States Dollars

: Government Finance Statistics (1999) (Defense Expenditures)

: IDB (2000) (Total Population)

13. $Tax_{i\,t}$ = General Government Tax Revenues as Percentage of GDP

: The ratio of total tax revenues at all levels of government to Gross Domestic Product.

: Government Finance Statistics (1999) (Tax Revenues)

: World Development Indicators (2000) (Gross Domestic Product)

14. $M2_{i\,t}$ = M2 as a Percentage of GDP

: World Development Indicators (2000)

15. $GDI_{I\,t}$ = Gross Domestic Investment Per Capita

: Expressed in United States Dollars

: World Development Indicators (2000)

APPENDIX C

SAMPLE APPENDIX

	Country	Observation Period
1	Argentina[132]	1987-1997
2	Australia	1972-1996
3	Austria	1975-1989
4	Azerbaijan	1994-1997
5	Belgium[133]	1978-1988
6	Bolivia[134]	1986-1997
7	Brazil[135]	1981-1994
8	Bulgaria	1988-1997
9	Canada[136]	1974-1995

[132] For the period 1988-1990, subnational government data for education, health, and social security and welfare expenditures are not reported.

[133] Data for subnational government data for education, health, and social security and welfare expenditures are not reported.

[134] Data for subnational government data for education, health, and social security and welfare expenditures are reported only for 1994-1998.

[135] Data for subnational government data for education, health, and social security and welfare expenditures are not reported.

[136] Data for education, health, and social security and welfare expenditures are not reported for local governments for the period 1974-1978.

10	Chile[137]	1975-1988 1992-1997
11	Costa Rica[138]	1977-1980 1982-1985 1987-1995
12	Croatia[139]	1994-1996
13	Denmark	1975-1989
14	Dominican Republic[140]	1977, 1980, 1982, 1987, 1990, 1992, 1996
15	Estonia	1992-1996
16	Fiji[141]	1980-1992
17	Finland[142]	1972-1989
18	France[143]	1975-1989
19	Hungary	1982-1989
20	Indonesia	1981-1993
21	India	1975-1996

[137] Data for local revenues and expenditures are not reported for 1989-1991.

[138] Data for subnational government revenues and expenditures for 1986 are not reported. Socio-economic data is not reported for 1982 and 1986.

[139] Data for subnational government data for education, health, and social security and welfare expenditures are not reported for 1994.

[140] Data for subnational government data for education, health, and social security and welfare expenditures are not reported for local governments.

[141] Only budgetary data is reported for central government operations. For the period 1980-1984, subnational government data for education, health, and social security and welfare expenditures are not reported.

[142] Data for subnational government data for education, health, and social security and welfare expenditures are not reported.

[143] Data for subnational government data for education, health, and social security and welfare expenditures are not reported for the periods of 1972-1977 and 1994-1997.

22	Ireland[144]	1972-1989
23	Israel[145]	1974-1989
24	Kenya[146]	1977-1984 1986-1994
25	Latvia	1994-1997
26	Lithuania	1993-1996
27	Malaysia[147]	1974-1979 1981-1997
28	Mauritius[148]	1975-1985 1987-1997
29	Mexico[149]	1977-1997
30	Netherlands[150]	1975-1997
31	Norway[151]	1972-1991
32	Panama	1985-1994

[144] Data for subnational expenditures on defense, education, health, and social security and welfare expenditures are not reported for 1976-1979.

[145] Data for subnational expenditures on defense, education, health, and social security and welfare are not reported for 1974-1975.

[146] Data for subnational expenditures on defense, education, health, and social security and welfare expenditures are not reported for 1972-1976. Subnational data are not reported for 1985.

[147] Data for subnational expenditures on defense, education, health, and social security and welfare expenditures are not reported. Subnational data prior to 1980 is not fully reported at the local level.

[148] Data for subnational expenditures on defense, education, health, and social security and welfare expenditures are not reported prior to 1987. Revenue and expenditure data is not reported for 1986.

[149] Data for subnational expenditures on defense, education, health, and social security and welfare expenditures are not reported.

[150] Data for subnational expenditures on defense, education, health, and social security and welfare expenditures are only reported for the period 1991-1997.

[151] Data for subnational expenditures on defense, education, health, and social security and welfare expenditures are not reported for the period of 1972-1979.

33	Peru	1990-1995
34	Philippines[152]	1980-1992
35	Paraguay[153]	1974-1980 1984-1993
36	Poland	1994-1997
37	Romania[154]	1991-1997
38	South Africa[155]	1977, 1980, 1982, 1993, 1995-1997
39	Spain[156]	1975-1989
40	Sweden[157]	1975-1996
41	Switzerland[158]	1975-1984
42	Thailand[159]	1977, 1980, 1982, 1987, 1990 -1997

[152] Data for subnational expenditures on defense, education, health, and social security and welfare expenditures are not reported.

[153] Data for subnational expenditures on defense, education, health, and social security and welfare expenditures are not reported. Subnational government revenues and expenditures are not reported for 1981-1983.

[154] Data for subnational expenditures on defense, education, health, and social security and welfare expenditures are not reported for the period 1972-1976.

[155] Subnational government data for education, health, and social security and welfare expenditures are only reported for 1977, 1978, and 1982.

[156] Subnational government data for education, health, and social security and welfare expenditures are not reported. Regional government data reported separately beginning in 1980.

[157] Data for subnational government defense, education, health, and social security expenditures are not reported.

[158] For the period 1984-1990, the GFS only contains data on tax revenues for the consolidated, budgetary, regional, and local governments.

[159] Data for subnational expenditures on defense, education, health, and social security and welfare are not reported for the period of 1972-1987.

43	United Kingdom[160]	1973-1995
44	United States[161]	1972-1997
45	Zimbabwe	1977, 1980, 1982-1991

[160] Data for subnational expenditures on defense, education, health, and social security and welfare are not reported for the period of 1972-1978.

[161] Data for subnational expenditures on defense, education, health, and social security and welfare are not reported for the period of 1972-1979.

APPENDIX D

ESTIMATION APPENDIX

Introduction

The purpose of this estimation appendix to discuss in detail the estimation methodologies that we employ in Chapters Four and Five for the estimation of the influence of fiscal decentralization. In this Appendix, we will discuss the two-way error components estimator for balanced panels to set the foundation for the discussion of the two-way error components estimator for unbalanced panels. We will also review the least squares estimator for unbalanced panels. In the latter sections of this Appendix, we will present the empirical tests that we use in Chapter Five for the issues of serial correlation, heterogeneity, and endogeneity. We conclude the Appendix with the presentation of the results of the empirical tests.

Two-Way Error Components Model for a Balanced Panel

In this section, we discuss the formation of the two-way fixed and random effects error components models for balanced panels that are modified in the succeeding section for application in the case of unbalanced panels. We believe that this course of discussion is appropriate given that, in many instances, the unbalanced approach is a modification of the balanced panel approach. First, we assume that i and t denote individuals and time respectively, then the general form of two-way error components model for a balanced panel is

$$y_{it} = X_{it}'\beta + u_{it} \qquad i = 1,\ldots,N \quad t = 1,\ldots,T \tag{56}$$

where we can decompose the error term u_{it}

$$u_{it} = \mu_i + \lambda_t + \nu_{it} \qquad i = 1,\ldots,N \quad t = 1,\ldots,T \tag{57}$$

where μ_i represents the unobservable country specific effect, λ_t the unobservable time specific effect, and ν_{it} is the remainder stochastic disturbance term. If the μ_i and λ_t are fixed parameters to be estimated, then we have specified a two-way fixed effects error components model. On the other hand, if the μ_i and λ_t are randomly distributed parameters to be estimated, then we have specified a two-way random effects error components model. As we discuss below, the assumptions underlying the specification of the fixed and random effects models significantly influence our decision to use the two-way fixed effects model to investigate the influence of fiscal decentralization in Chapter Five of this dissertation.

Two-Way Fixed Effects Error Components Model

If we assume that the μ_i and λ_t are fixed parameters to be estimated; the ν_{it} are identically, independently distributed (IID) with zero mean and constant variance ($\nu_{it} \sim \text{IID}(0, \sigma_\nu^2)$); X_{it} represents the matrix of regressors and the X_{it} are independent of ν_{it} for all i and t; y_{it} represents the dependent variable of interest; and the number of individuals observed at any period is the same throughout the sample, then Equations (56) and (57) represent a two-way fixed effects error components model for balanced panels. We can define Z_λ as the $NT \times T$ matrix of time dummies and Z_μ as the $NT \times N$ matrix of individual dummies; ι_T , ι_N as vectors of ones of dimension T and N, respectively, and I_T, I_N as identity matrices of dimension T and N, respectively, so that

$$\begin{aligned} Z_\lambda &= \iota_N \times I_T \\ Z_\mu &= \iota_T \otimes I_N \end{aligned} \tag{58}$$

and the potential loss of degrees of freedom is significant when N or T is large. Following Hsiao (1987) and Baltagi (1995), we can perform the standard Within transformation by pre-multiplying (56) by Q where

$$Q = E_N \otimes E_T = I_N \otimes I_T - I_N - \bar{J}_T - \bar{J}_N \otimes I_T + \bar{J}_N \otimes \bar{J}_T \tag{59}$$

where

$$\begin{aligned} E_N &= I_N - \bar{J}_N \\ E_T &= I_T - \bar{J}_T \\ \bar{J}_N &= \frac{J}{N} \\ \bar{J}_T &= \frac{J}{T} \end{aligned} \tag{60}$$

and J_N, J_T are matrices of ones of dimension N and T, respectively. The Q matrix transforms or "sweeps" the μ_i and λ_t from the transformed regression equation or

$$\begin{aligned} y^* &= X^* \beta^* + u^* \\ Q y &= Q X Q \beta + Q u \end{aligned} \tag{61}$$

where $\beta^* = Q\,\beta = (X'QX)^{-1}X'Qy$ and the typical element is

$$(y_{it} - \bar{y}_{i.} - \bar{y}_{.t} - \bar{y}_{..}) = (x_{it} - \bar{x}_{i.} - \bar{x}_{.t} - \bar{x}_{..})\beta + (\nu_{it} - \bar{\nu}_{i.} - \bar{\nu}_{.t} - \bar{\nu}_{..}) \quad \textbf{(62)}$$

where the bar indicates the mean of the variable and the subscript indicates whether the mean of the variable is with respect to individuals, time, or with respect to both individuals and time. The first element of the subscript pertains to individuals, while the second element pertains to time. If an element of the subscript contains a period, this indicates how the variable in question is averaged.

Equation (62) illustrates the transformation of the regression equation by the Within estimation and highlights one of the potential tradeoffs of using a fixed effects estimator. The Within transformation "sweeps" the fixed effects dummies from the regression equation by subtracting the time-invariant and individual-invariant means from the dependent and independent variables. In the same process, the Within transformation "sweeps" out any time-invariant or individual-invariant variables, and thus the fixed effects model cannot be estimated with time-invariant or individual-invariant regressors as the Within transformation would result in a less than full rank *X* matrix.

Two-Way Random Effects Error Components Model

If we believe that the μ_i and λ_t are random parameters to be estimated, then we can use the two-way random effects error components model to estimate the influence of fiscal decentralization on economic growth with a balanced panel. Unlike the fixed effects approach, we assume that the μ_i ,λ_t , and ν_{it} are each identically, independently distributed with zero mean and constant variance such that

$$\begin{aligned} \mu_i &= IID\,(0,\sigma^2_\mu) \\ \lambda_t &= IID\,(0,\sigma^2_\lambda) \\ \nu_i &= IID\,(0,\sigma^2_\nu) \end{aligned} \quad \textbf{(63)}$$

and the μ_i ,λ_t , and ν_{it} are independent of each other. We must also assume that the X_{it} are independent of μ_i , λ_t , and ν_{it} for all i and t and that the disturbances are homoscedastic for all i and t. Continuing to follow Baltagi (1995), the variance-covariance matrix for u is

$$\Omega = E(uu) = Z_\mu E(\mu\mu) Z'_\mu + Z_\lambda E(\lambda\lambda) Z'_\lambda + \sigma^2_\nu I_{NT} \tag{64}$$

$$\Omega = \sigma^2_\mu (I_N \otimes J_T) + \sigma^2_\lambda (J_N \otimes I_T) + \sigma^2_\nu (I_N \otimes I_T) \tag{65}$$

Under these assumptions, the Generalized Least Squares (GLS) estimator for the two-way random effects error components model is

$$\hat{\beta}_{GLS} = W_1 \hat{\beta}_W + W_2 \hat{\beta}_B + W_3 \hat{\beta}_c \tag{66}$$

where the GLS estimator is the weighted averaged of three estimators. The first estimator (β_W) is the standard Within estimator which results from the transformation of the regression by $Q_1 = E_N \otimes E_T$. The second estimator (β_B) is the between individuals estimator resulting from the transformation of the regression by $Q_2 = E_N \otimes \underline{J}_N$ while the third estimator (β_C) is the between time periods estimator resulting from the transformation of the regression by $Q_2 = \underline{J}_T \otimes E_T$.[162]

Having discussed the properties of the two-way fixed and random effects error components estimators, we now turn to the question of which estimator is unbiased and efficient. In the presence of

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[162] See p.32-33 of Baltagi (1995) for the complete specification of the two-way random effects GLS model for balanced panels.

panel data and individual specific and time specific effects, Ordinary Least Squares (LS) is unbiased but inefficient and the standard errors of the parameter estimates are biased. The Within estimator is unbiased and consistent. In the presence of homoscedastic errors and under the assumption of independence among the regressors, the time and individual specific effects, and the stochastic remainder disturbances, the random effects GLS estimator is unbiased, consistent, and efficient and the Within estimator is inefficient but still unbiased and consistent. While the random effects GLS estimator is efficient relative to the fixed effects Within estimator, it is only so under the strict set of assumptions noted above. The unbiased and consistent nature of the Within estimator is not dependent upon the independence of the regressors and the time and individual specific effects.[163] Furthermore, the consistency of the Within estimator is not, as with the GLS estimator, dependent upon the assumption of homoscedastic disturbances. While the standard errors of the Within estimator are biased in the presence of heteroscedastic disturbances, the Within estimator is consistent, and White's (1980) variance-covariance transformation can be applied to derive the robust standard errors. In the presence of heteroscedasticity, the GLS estimator, unlike the Within estimator, is inconsistent.

Two-Way Error Components Model for Unbalanced Panels

To this point, our discussion has focused on the two-way error components models for balanced panels where the individuals in the sample are observed over the entire sample period. As noted in Chapter Four and illustrated in Appendix C, we do not observe all the countries in the sample

[163] See Hausman and Taylor (1981).

for all the time periods, so we must account for the unbalanced nature of the sample. We will, as in the previous section, first discuss the fixed effects estimator before turning to the random effects estimator.

Two-Way Fixed Effects Error Components Model

Following Hsiao (1986) and Baltagi (1995), we can specify the general form of the unbalanced two-way error components panel data model as

$$y_{it} = X_{it}'\beta + u_{it} \qquad i = 1,\ldots,N_t \quad t = 1,\ldots,T \tag{67}$$

with i denoting countries and t denoting time. If the sample were balanced, i would range from 1 to N, where N represents the number of countries in the sample. However, the sample is unbalanced and i ranges from 1 to N_t where N_t ($N_t \leq N$) denotes the number of countries observed in year t and $n = \Sigma^t N_t$. Drawing upon Baltagi (1995), we can decompose the error term u_{it}

$$u_{it} = \mu_i + \lambda_t + \nu_{it} \qquad i = 1,\ldots,N_t \quad t = 1,\ldots,T \tag{68}$$

where μ_i represents the unobservable country specific effect, λ_t the unobservable time specific effect, and ν_{it} is the remainder stochastic disturbance term. Let D_t be the ($N_t \times N$) matrix obtained from the identity matrix I_n by omitting the rows corresponding to countries not observed in year t, ι_t be the vector of ones of dimension T, and define

$$\Delta = (\Delta_1, \Delta_2) = \begin{bmatrix} D_1 & D_1\iota_N & \cdots & \cdots \\ \vdots & \vdots & & \\ \vdots & & \ddots & \\ D_t & \cdots & & D_T\iota_N \end{bmatrix} \tag{69}$$

where $\Delta_1 = (D_1^{'}, ..., D_T^{'})$ is $n \times N$ and $\Delta_2 = \text{diag}[\, D_{\iota}^{1}{}_{N} \,]$ is $n \times T$. The matrix Δ defines the dummy variable structure for the unbalanced panel data model. Note that for complete panels, $\Delta_1 = (\iota_t \otimes I_n)$ and $\Delta_2 = (I_T \otimes \iota_n)$.

If we assume that the μ_i and λ_t are fixed parameters to be estimated; the ν_{it} are identically, independently distributed (IID) with zero mean and constant variance ($\nu_{it} \sim \text{IID}\,(0, \sigma_\nu^2)$); X_{it} represents the matrix of regressors and the X_{it} are independent of ν_{it} for all i and t; and y_{it} represents the dependent variable of interest, then we can estimate the impact of fiscal decentralization using a two-way fixed effects error components model and the Within transformation for unbalanced two-way fixed-effects error components models. We note that $\Delta_N \equiv \Delta_1^{'} \Delta_1 = \text{diag}[T_i]$ is the number of time periods that country i is observed in the panel. Furthermore, we can define $\Delta_T \equiv \Delta_2^{'} \Delta_2 = \text{diag}[N_T]$ as the $(T \times N)$ matrix of zeros and one indicating the absence or presence of a country in time period t. Note that for complete panels, $\Delta_N = TI_N$ and $\Delta_T = N\, I_T$ and $\Delta_{NT} = \iota_T\, \iota_N^{'} = J_{TN}$.

Let J_N be a matrix of ones of dimension N and $\underline{J}_N = J_N / N$ and J_T be a matrix of ones of dimension T and $\underline{J}_T = J_T / T$. We can define $E_N = I_N - \underline{J}_N$ and $E_T = I_T - \underline{J}_T$ and note that E and I are symmetric, idempotent, orthogonal to each other, and sum to the identity matrix. The $\underline{J}$ matrices are average matrices while the E matrices are the deviation from the means matrices. Continuing to follow Baltagi (1995), we can define

$$\bar{\Delta} = \Delta_2 - \Delta_1 \Delta_N^{-1} \Delta'_{TN} = \bar{P}_{\Delta_1} \Delta_2 \tag{70}$$

$$\bar{P}_{\Delta_1} = I_N - \Delta_1 (\Delta'_1 \Delta_1)^{-1} \Delta'_1 \tag{71}$$

In the complete panel case, $P = NE_T$. For the unbalanced panel case, we must assume that each country is observed at least twice in which case rank(P) = T - 1. Under this assumption, it can be shown that the Within transformation matrix for the two-way unbalanced fixed effects model is

$$Q = (I_N - \Delta_1 \Delta^{-1}{}_N \Delta'_N) - \bar{\Delta} P^{-1} \bar{\Delta}' \tag{72}$$

and the Within transformation can be performed as LS after premultiplying the data by Q. LIMDEP, which is the statistical software that we use to conduct the empirical analysis, detects the unbalanced nature of the sample and conducts the above transformation accordingly.

Two-Way Random Effects Error Components Model

We will now briefly discuss the properties of the two-way random effects GLS estimator for unbalanced panels. As discussed earlier in this Appendix and in Chapter Four, we will use the two-way fixed effects Within estimator to estimate the hypothesized influence of fiscal decentralization on its direct and indirect outcomes. Given our a priori assumption about the presence of heteroscedasticity and serial correlation, we believe that the Within estimator is more appropriate to the task at hand and more robust in the presence of these econometric issues. We will, however, present the results of the two-way random effects GLS estimator for illustrative purposes, hence our discussion in this section on the properties of the two-way GLS estimator for unbalanced panels.

Continuing to follow Baltagi (1995), we can define $\mu' = (\mu_1, ..., \mu_{Nt})$, $\lambda' = (\lambda_1, ..., \lambda_T)$, and ν as identically, independently distributed random variables with zero mean and constant variance. As noted in our discussion of two-way GLS estimators for balanced panels, μ, λ, and ν are distributed independently of each other, that is, $E(\mu_{it} \mid \lambda_{it}) = E(\lambda_{it} \mid \mu_{it}) = E(\mu_{it} \mid \nu_{it}) = E(\lambda_{it} \mid \nu_{it}) = 0$. We can write the unbalanced two-way GLS model as

$$\begin{aligned} y &= X\beta + u \\ u &= \Delta_1 \mu + \Delta_2 \lambda + \nu \end{aligned} \tag{73}$$

where Δ_1 and Δ_2 are as defined in the previous section. The variance-covariance matrix for the unbalanced two-way GLS estimator is

$$\Omega = E(uu') = \sigma_\nu^2 I_N + \sigma_\mu^2 \Delta_1 \Delta_1' + \sigma_\lambda^2 \Delta_2 \Delta_2' \tag{74}$$

As noted by Baltagi (1995), the feasible expression for Ω^{-1} is "messy and asymmetric" in individuals and time. The complicated and asymmetric nature of the feasible variance-covariance matrix presents another obstacle to the construction of the two-way feasible GLS estimator under the assumptions of homoscedasticity and no serial correlation. When either heteroscedasticity or serial correlation is present, the feasible expression of Ω^{-1} becomes even more complicated.

Under the assumptions of homoscedasticity, no serial correlation, and independence of the effects and the stochastic remainder disturbances, the feasible expression Ω^{-1} is

$$\sigma_\nu^2 \Omega^{-1} = V - V \Delta_2 \bar{P}^{-1} \Delta_2' V \tag{75}$$

where

$$
\begin{aligned}
V &= I_N - \Delta_1 \overline{\Delta_N}^{-1} \Delta_1 && (n \times n) \\
\overline{P} &= \overline{\Delta_T} - \Delta_{TN} \overline{\Delta_N}^{-1} \Delta_{TN}' && (T \times T) \\
\overline{\Delta_N} &= \Delta_N + (\sigma_v^2 / \sigma_\mu^2) I_N && (N \times N) \\
\overline{\Delta_T} &= \Delta_T + (\sigma_v^2 / \sigma_\lambda^2) I_T && (T \times T)
\end{aligned}
\qquad \textbf{(76)}
$$

We refer the reader to p. 160-161 of Baltagi (1995) for the methods of estimating the unbalanced two-way GLS variance-covariance matrix. Given what we view as the strong assumptions on the independence of the individual and time specific effects and the regressors and the computational issues with respect to estimating the variance-covariance matrix of the GLS estimator, we believe the unbalanced two-way Within estimator is more appropriate for the task of estimating the influence of fiscal decentralization. While the random effects GLS estimator is unbiased, consistent, and efficient relative to the fixed effects Within estimator in balanced panels and under the assumptions that we have discussed in this appendix, we do not believe that, given our a priori assumptions of heteroscedastic and serially correlated disturbances, that the random effects GLS estimator is best suited for the task at hand.

Econometric Issues

Having discussed the general form of the two-way fixed effects and random effects estimators, we now turn to the econometric issues that, if left untreated, may confound our estimates of the impact of fiscal decentralization. By using panel data, we are able to investigate the influence of fiscal decentralization over countries and time. However, the use of panel data set in empirical estimation also presents a number of econometric problems. In particular in this section, we discuss the issues of serial correlation, endogeneity, and heteroscedasticity.

Serial Correlation

If serial correlation is present, that is, the disturbances are correlated across time, the pooled Least Squares (LS) and Within estimators are inefficient and the parameter estimates are adversely effected. In the presence of serial correlation, the random effects GLS estimator is inconsistent.[164] Given that we are estimating two different types of models (pooled LS and two-way error components), we conduct two tests for serial correlation. We believe that this approach is appropriate in the event that the individual and time specific effects are jointly equal to zero and the pooled LS model is the best linear unbiased estimator for the investigation of the impact of fiscal decentralization. On the other hand, if the individual or time specific effects are singularly or jointly different from zero, then testing for serial correlation with the two-way error components estimator is more appropriate as the standard errors of the pooled LS estimator will be biased.

For the pooled LS estimator, the most common statistical test for the presence of serial correlation is the Durbin-Watson test, which is based on the principle that if the true disturbances are serially correlated, then the least squares residuals are also serially correlated.[165] The Durbin-Watson test statistic is equal to the sum of the squared differences of the residual and the one-period lag of the residual divided by the sum of the squared residuals or

---

[164] For a discussion of serial correlation and time series analysis, see Hamilton (1994).

[165] See Chapter 13 of Greene (1997) for additional information on the Durbin-Watson test for the LS estimator. See Chapter 5 of Baltagi (1995) for additional information on testing for serial correlation in the presence of panel data.

$$d = \frac{\sum_{t=2}^{T} (\hat{u}_{it} - \hat{u}_{it-1})^2}{\sum_{t=2}^{T} \hat{u}_{it}^2} \qquad \textbf{(77)}$$

where the null hypothesis is that $\rho = 0$ against the alternative that $|\rho| <> 0$. As expected a priori, we strongly reject the null hypothesis of no serial correlation at the 1% significance level for each of the estimation equations in levels (Table D-1). We then first difference each of the estimation equations and re-estimate the equations in first differences to determine if serial correlation is present in the first differenced residuals. We fail to reject the null hypothesis of no serial correlation for each of the estimation equations in first differences and conclude that first differencing is the appropriate course of action (Table D-2).

While we have detected the presence of serial correlation in the least squares estimation equations that are estimated in levels, the question remains whether serial correlation is present in the fixed effects estimation equations estimated in levels. It is possible that once we have controlled for the individual or time specific fixed effects, that the serial correlation detected in the least squares residuals is not present in the Within residuals. Following Bhargava, Franzini, and Narendranathan (1982), we can use the Durbin-Watson statistic based on the Within residuals rather than the LS residuals to examine the hypothesis of no serial correlation. In this case, the Durbin-Watson statistic is

$$d_w = \frac{\sum_{t=2}^{T} (\hat{v}_{it} - \hat{v}_{it-1})^2}{\sum_{t=2}^{T} \hat{v}_{it}^2}$$

As before, we examine the null hypothesis $\rho = 0$ against the alternative that $|\rho| <> 0$. As expected a priori, we strongly reject the null hypothesis of no serial correlation at the 1% significance level for each of the estimation equations in levels (Table D-1). We then first difference each of the estimation equations and re-estimate the fixed effects equations in first differences to determine if serial correlation is present in the first differenced Within residuals. We fail to reject the null hypothesis of no serial correlation for each of the estimation equations in first differences and conclude that first differencing is the appropriate (Table D-2).

Heteroscedasticity

To this point, we have explicitly assumed that the stochastic remainder disturbance terms for the two-way error components estimators are homoscedastic with zero mean and constant variance. We noted in Chapter Four that the assumption of homoscedastic disturbances may be overly restrictive given the observable variation among the countries in the panel data set. If the disturbances are heteroscedastic, then the LS and Within estimators will still be consistent but the parameter estimates will not be efficient. The estimated standard errors of the LS and Within parameter estimates will also be biased while the GLS estimator will be inconsistent.

We can use the Koenker and Bassett (1982) and Breusch and Pagan (1979) Lagrangian Multiplier tests to determine whether we can reject the null hypothesis of homoscedasticity. Under the assumption of normality, the Koenker-Bassett and Breusch-Pagan tests have the same asymptotic distribution, but the Koenker-Bassett test has been argued to be more robust than the Breusch-Pagan test in the presence of non-normal distributions.[166] Under the null hypothesis, both tests are distributed as chi-squared with *K* degrees of freedom. The Breusch-Pagan test is

$$LM = .5 * \left[\left(\frac{\hat{u}_{it}^2}{\frac{\hat{u}'\hat{u}}{n}} \right)' X (X'X)^{-1} X' \left(\frac{\hat{u}_{it}^2}{\frac{\hat{u}'\hat{u}}{n}} \right) - n \right]$$

The Koenker-Bassett test is based on a more robust estimator of the variance or

$$V = \frac{1}{n} \sum_{i=1}^{n} \left[\hat{u}_{it}^2 - \frac{\hat{u}'\hat{u}}{n} \right]^2$$

and the Koenker-Bassett test statistic is equal to

$$LM = \left[\frac{1}{V} \right] \left(\hat{u}_{it}^2 - \frac{\hat{u}'\hat{u}}{n} \right)' X (X'X)^{-1} X' \left(\hat{u}_{it}^2 - \frac{\hat{u}'\hat{u}}{n} \right)$$

We believe that it is appropriate to, as with the examination of the question of serial correlation, to examine the question of heteroscedasticity for the pooled LS and fixed effects models. As before, if the country and time specific effects are jointly equal to zero, the pooled LS model will be the best

[166] See p.553 of Greene (1997). See also Koenker (1981) and Koenker and Bassett (1982).

linear unbiased and efficient estimator of the influence of fiscal decentralization, hence the need to test for the presence of heteroscedasticity in the LS residuals. On the other hand, if the country specific or time specific effects are not equal to zero, then the Within estimator will be more efficient than the LS estimator, hence the need to examine the question of heteroscedasticity with the Within residuals.

For the pooled least squares model, the Koenker-Bassett test statistic is 32.69 and the Breusch-Pagan test statistic was 298.17 for n = 565. For the one-way country fixed effects model, the Koenker-Bassett test statistic is 24.12 and the Breusch-Pagan test statistic is 110.19. For the two-way fixed effects model, the Koenker-Bassett test statistic is 56.89 and the Breusch-Pagan test statistic is 569.87. Based upon these results, we reject the null hypothesis of homoscedasticity at the 1% significance level. We can use the White estimator to construct the robust covariance matrix for the LSDV estimator.

Given that we are using the LS and Within estimators to examine the influence of fiscal decentralization, we need to specify the heteroscedastically consistent variance-covariance matrix for each of the estimators. For the LS estimator, under the assumption that the country and time specific effects are jointly equal to zero, we can specify the heteroscedastically consistent variance-covariance matrix as

$$Var[b] = \sigma^2 [X' X]^{-1} [X' \Omega X] [X' X]^{-1} \tag{82}$$

where we would need an estimate of $\sigma^2 \Omega$ to calculate the estimate of the variance-covariance matrix. Following Greene (1997), we note that in order to estimate the variance-covariance matrix, what is needed is an estimate of

$$\Sigma = \frac{1}{n} \sigma^2 X' \Omega X = \frac{1}{n} \sum_{i=1}^{n} \sigma_{it}^2 x_{it} x_{it}' \tag{83}$$

which, as shown by White (1980), can be estimated consistently by

$$S_0 = \frac{1}{n} \sum_{i=1}^{n} \hat{u}_{it} x_{it} x_{it}' \tag{84}$$

and the White variance-covariance estimator for the LS estimator is

$$\hat{Var}[b] = n (X' X)^{-1} S_0 (X' X)^{-1} \tag{85}$$

For the two-way error components model, we can define the full regressor matrix **Z** as equal to the combination of the dummy variable matrix Δ with the **X** matrix of explanatory variables or **Z** = [Δ, **X**].

Following Greene (1997), the White heteroscedastically consistent estimator for the covariance matrix is the lower right block of the matrix where **E** is a diagonal matrix of Within estimator residuals. We note that the White estimator for the fixed effects model is similar to the White estimator for the LS

$$\hat{Var}[a, b] = (Z' Z)^{-1} Z' E^2 Z (Z' Z)^{-1} \tag{86}$$

model and that we can use is the White estimator in the presence of homoscedasticity without adversely affecting the parameter estimates or the standard errors of the parameter estimates. In the event that we improperly reject the null hypothesis of homoscedasticity, the use of the White estimator does not result in inefficient or inconsistent estimates. To estimate the LS and fixed effects models with the White variance-covariance matrix, we can include the "HET" option in the LIMDEP command statement.

Endogeneity

We use the Hausman (1978) specification test to test for the endogeneity of the fiscal decentralization variable.[167] Under the null hypothesis that the disturbances and regressors are uncorrelated, the least squares (LS) and the two-stage least squares (2SLS) estimators are both consistent, however, the LS estimator is more efficient than the 2SLS estimator. Under the alternative hypothesis where the disturbances and regressors are correlated, the 2SLS estimator is consistent, while the LS estimator is inconsistent. The Hausman test is constructed by comparing the two sets of parameter estimates from the LS and 2SLS estimators.[168] Let b_{ls} be the vector of LS parameter estimates, β_{2sls} the vector of 2SLS parameter estimates, and Σ the difference of the covariance matrices for b_{ls} and β_{2sls}. The Hausman test is based on the Wald criterion or

$$W = \chi^2 [K] = [b_{ls} - \hat{\beta}_{2sls}]' \hat{\Sigma}^{-1} [b_{ls} - \hat{\beta}_{2sls}] \tag{87}$$

Under the null hypothesis, the Hausman test is distributed as chi-squared with K degrees of freedom. While the Hausman (1978) specification test is sufficient for the pooled LS models of fiscal decentralization, we need to also investigate whether endogeneity is present in the fixed effects models

[167] See Hausman (1978) and Greene (1997).

[168] Note that if an intercept term is included in the specification of the estimation equation, it is not included in the conduct of the Hausman test.

of fiscal decentralization. To do so, we follow Hausman and Taylor (1981) by modifying the Hausman (1978) test to use the Within estimator and residuals, or

$$W = \chi^2 [K] = [\hat{\beta}_W - \hat{\beta}_{W_{IV}}]' \hat{\Sigma}^{-1} [\hat{\beta}_W - \hat{\beta}_{W_{IV}}] \qquad \textbf{(88)}$$

where β_W be the vector of Within parameter estimates, β_{WIV} the vector of Within IV parameter estimates, and Σ the difference of the covariance matrices for β_W and β_{WIV}. To conduct the specification test, we first run the two-way fixed effects model of per capita GDP on fiscal decentralization and other explanatory variables. We then run the first stage regression of fiscal decentralization on the instrumental variables and then, using the fitted value for fiscal decentralization, the second stage fixed effects regression for per capita GDP.

Table 48

Testing for Serial Correlation - Levels

Dependent Variable	Durbin-Watson (LS)	Durbin-Watson (Country Effects Only)	Durbin-Watson (Time Effects Only)	Durbin-Watson (Country and Time Effects)
Infant Mortality (Deaths per 1,000 Live Births)	0.2280	0.0002	0.0002	0.1550
Gross Domestic Private Fixed Investment (% of GDP)	0.4281	0.0056	0.3699	0.1580
Gross Domestic Public Fixed Investment (% of GDP)	0.4396	0.0038	0.0095	0.1742
Inflation Rate	0.7737	0.1049	0.0654	0.2986
Gini Coefficient	0.1054	0.0003	0.0001	0.0680
Democratic Governance	0.9726	0.1662	0.4052	0.2245
Gross Domestic Product	0.2607	0.0012	0.0003	0.1551

Note: All variables measured in natural logarithms. *Expdec* was used as the measure of fiscal decentralization in the regressions to develop the Durbin-Watson and Breusch-Godfrey statistics. Using *Revdec* produced similar results.

: Testing for Serial Correlation - Levels

Table 49

Testing for Serial Correlation - Period to Period Differences

Dependent Variable[169]	Durbin-Watson (LS)	Durbin-Watson (Country Effects Only)	Durbin-Watson (Time Effects Only)	Durbin-Watson (Country and Time Effects)
Infant Mortality (Deaths per 1,000 Live Births)	2.0305	1.5628	1.5418	1.8394
Gross Domestic Private Fixed Investment (% of GDP)	1.9138	1.8339	1.8946	1.8332
Gross Domestic Public Fixed Investment (% of GDP)	2.2899	2.2422	2.2263	2.2853
Inflation Rate	1.8632	1.8424	1.8585	1.8484
Gini Coefficient	1.9863	1.1978	1.3847	0.9203
Democratic Governance	2.0131	1.9795	1.9984	2.0031
Gross Domestic Product	1.7146	1.5118	1.5370	1.6358

Note: All variables measured in natural logarithms. *Expdec* was used as the measure of fiscal decentralization in the regressions to develop the Durbin-Watson and Breusch-Godfrey statistics. Using *Revdec* produced similar results.

[169] All variables measured in natural logarithms. *Expdec* was used as the measure of fiscal decentralization in the regressions to develop the Durbin-Watson and Breusch-Godfrey statistics. Using *Revdec* produced similar results.

APPENDIX E

ESTIMATION RESULTS APPENDIX

This Appendix is divided into sections corresponding to the seven testable hypotheses described in Chapter Three, specified in Chapter Four, and estimated in Chapter Five. The results contained in this Appendix are those estimations which were conducted, but not reported in Chapter Five. The results reported in Chapter Five are for those individual and/or time specific effects which could not be rejected as equal to zero. In the event that the hypothesis that the time and individual specific effects are equal to zero are rejected, the estimation results for the two-way error components models are reported in Chapter Five and the estimation results for the one-way time specific and one-way individual specific error component models are reported in this Appendix.

Table 50

Estimation Results for All Sample Countries

Infant Mortality with Expenditure Decentralization

Variable	Within One-Way Country Effects	GLS One-Way Country Effects	Within One-Way Time Effects	GLS One-Way Time Effects
Expenditure Decentralization	0.0127 (0.0202)	0.0006 (0.0198)	-0.0088 (0.0212)	-0.0048 (0.0204)
Urbanization (% of Total Population)	–1.6744** (0.4186)	-0.4376^{+} (0.2327)	-0.3102 (0.2343)	–0.2714 (0.2083)
Health Expenditure (Per Capita)	-0.0261** (0.0082)	-0.0309** (0.0085)	-0.0315** (0.0089)	-0.0316** (0.0088)
Openness to Trade (% of Gross Domestic Product)	0.0178 (0.0276)	-0.0058 (0.0271)	-0.0375 (0.0403)	-0.0151 (0.0284)
Defense Expenditure (Per Capita)	0.0405 (0.0171)	0.0378 (0.0159)	0.0483** (0.0168)	0.0413** (0.0164)
Gross Domestic Product (Per Capita)	-0.0051 (0.0307)	-0.0264 (0.0257)	-0.0528 (0.0409)	-0.0375 (0.0272)
Constant		-0.0346** (0.0039)		-0.0357** (0.0038)
df	504	548	524	548
R^2	0.1816	0.0350	0.0963	0.0366

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. N = 555. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table E-2

Estimation Results for All Sample Countries

Infant Mortality with Revenue Decentralization

Variable	Within One-Way Country Effects	GLS One-Way Country Effects	Within One-Way Time Effects	GLS One-Way Time Effects
Revenue Decentralization	-0.0044 (0.0185)	-0.0100 (0.0193)	-0.0104 (0.0185)	-0.0112 (0.0197)
Urbanization (% of Total Population)	–1.6952** (0.4175)	-0.5554* (0.2500)	-0.3139 (0.2396)	–0.2822 (0.2089)
Health Expenditure (Per Capita)	-0.0267** (0.0085)	-0.0309** (0.0086)	-0.0315** (0.0089)	-0.0317** (0.0088)
Openness to Trade (% of Gross Domestic Product)	0.0172 (0.0276)	-0.0049 (0.0273)	-0.0384 (0.0401)	-0.0162 (0.0285)
Defense Expenditure (Per Capita)	0.0389** (0.0166)	0.0372** (0.0158)	0.0493** (0.0163)	0.0417** (0.0162)
Gross Domestic Product (Per Capita)	-0.0032 (0.0298)	-0.0233 (0.0256)	-0.0545 (0.0395)	-0.0386 (0.0270)
Constant		-0.0337** (0.0043)		-0.0356** (0.0039)
df	504	548	524	548
R^2	0.1810	0.0334	0.0964	0.0371

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. *N* = 555. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 52

Estimation Results for Sample Developed Countries

Infant Mortality with Expenditure Decentralization

Variable	Within One-Way Country Effects	GLS One-Way Country Effects	Within Two-Way	GLS Two-Way
Expenditure Decentralization	-0.0882 (0.0956)	-0.1269 (0.0830)	-0.1593 (0.1002)	-0.1473^{+} (0.0824)
Urbanization (% of Total Population)	1.1900** (0.2056)	1.0936 (0.2737)	1.0813** (0.2346)	1.0600** (0.2741)
Health Expenditure (Per Capita)	-0.0050 (0.0112)	-0.0081 (0.0151)	-0.0057 (0.0102)	-0.0079 (0.0150)
Openness to Trade (% of Gross Domestic Product)	-0.1006^{+} (0.0609)	-0.1027 (0.0685)	-0.0479 (0.1062)	-0.0820 (0.0738)
Defense Expenditure (Per Capita)	-0.0316 (0.0456)	-0.0330 (0.0538)	-0.0281 (0.0543)	-0.0315 (0.0540)
Gross Domestic Product (Per Capita)	0.0322 (0.0575)	0.0294 (0.0624)	0.0425 (0.0944)	0.0331 (0.0657)
Constant		-0.0439 (0.0051)		-0.0447** (0.0062)
df	242	257	218	257
R^2	0.2439	0.2140	0.3505	0.2136

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. N = 264. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 53

Estimation Results for Sample Developed Countries

Infant Mortality with Revenue Decentralization

Variable	Within One-Way Country Effects	GLS One-Way Country Effects	Within Two-Way	GLS Two-Way
Revenue Decentralization	-0.1374^{+} (0.0846)	-0.1661* (0.0762)	-0.0960 (0.0859)	-0.1601* (0.0757)
Urbanization (% of Total Population)	1.0427** (0.2182)	0.9507** (0.2849)	1.1454** (0.2504)	0.9638** (0.2849)
Health Expenditure (Per Capita)	-0.0059 (0.0115)	-0.0083 (0.0150)	-0.0059 (0.0101)	-0.0084 (0.0149)
Openness to Trade (% of Gross Domestic Product)	-0.1124^{+} (0.0617)	-0.1157^{+} (0.0683)	-0.0629 (0.1025)	-0.1027 (0.0712)
Defense Expenditure (Per Capita)	-0.0329 (0.0442)	-0.0292 (0.0527)	-0.0148 (0.0531)	-0.0267 (0.0528)
Gross Domestic Product (Per Capita)	0.0259 (0.0551)	0.0167 (0.0614)	0.0256 (0.0920)	0.0177 (0.0634)
Constant		-0.0421** (0.0051)		-0.0426** (0.0057)
df	242	257	218	257
R^2	0.2491	0.2213	0.3456	0.2211

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. N = 264. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 54

Estimation Results for Sample Developing Countries

Infant Mortality with Expenditure Decentralization

Variable	Within One-Way Country Effects	GLS One-Way Country Effects	Within One-Way Time Effects	GLS One-Way Time Effects
Expenditure Decentralization	0.0179 (0.0205)	0.0073 (0.0195)	-0.0054 (0.0217)	-0.0025 (0.0206)
Urbanization (% of Total Population)	-1.5019^{**} (0.4176)	-0.8002^{**} (0.2852)	-0.2496 (0.3035)	-0.3324 (0.2412)
Health Expenditure (Per Capita)	-0.0366^{**} (0.0078)	-0.0413^{**} (0.0101)	-0.0402^{**} (0.0012)	-0.0430^{**} (0.0107)
Openness to Trade (% of Gross Domestic Product)	-0.0331 (0.0313)	-0.0102 (0.0288)	-0.0486 (0.0436)	-0.0166 (0.0308)
Defense Expenditure (Per Capita)	0.0499^{**} (0.0175)	0.0466^{**} (0.0160)	0.0481^{**} (0.0157)	0.0482^{**} (0.0168)
Gross Domestic Product (Per Capita)	-0.0158 (0.0360)	-0.0314 (0.0283)	-0.0893^{+} (0.0486)	-0.0593^{*} (0.0306)
Constant		-0.0245^{**} (0.0064)		-0.0293^{**} (0.0062)
df	257	285	262	285
R^2	0.3090	0.0830	0.2226	0.0913

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. N = 292. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 55

Estimation Results for Sample Developing Countries

Infant Mortality with Revenue Decentralization

Variable	Within One-Way Country Effects	GLS One-Way Country Effects	Within One-Way Time Effects	GLS One-Way Time Effects
Revenue Decentralization	0.0023 (0.0190)	-0.0028 (0.0191)	-0.0056 (0.0180)	-0.0055 (0.0200)
Urbanization (% of Total Population)	-1.5236** (0.4156)	-0.9374** (0.3067)	-0.2508 (0.3015)	-0.3356 (0.2418)
Health Expenditure (Per Capita)	-0.0374** (0.0082)	-0.0413** (0.0101)	-0.0402** (0.0118)	-0.0431** (0.0107)
Openness to Trade (% of Gross Domestic Product)	-0.0328 (0.0312)	-0.0132 (0.0291)	-0.0490 (0.0435)	-0.0178 (0.0310)
Defense Expenditure (Per Capita)	0.0478** (0.0170)	0.0458** (0.0160)	0.0486** (0.0153)	0.0484** (0.0166)
Gross Domestic Product (Per Capita)	-0.0125 (0.0348)	-0.0260 (0.0282)	-0.0904* (0.0472)	-0.0604* (0.0304)
Constant		-0.0232** (0.0072)		-0.0292** (0.0062)
df	257	285	262	285
R^2	0.3069	0.0764	0.2227	0.0914

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. N = 292. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 56

Estimation Results for All Sample Countries

Gross Domestic Private Fixed Investment Per Capita with Expenditure Decentralization

Variable	IV - Within One-Way Country Effects	IV - GLS One-Way Country Effects	IV - Within Two-Way	IV - GLS Two-Way
Expenditure Decentralization	-0.0573 (0.1094)	-0.0421 (0.0781)	-0.0419 (0.0994)	-0.0484 (0.0702)
Inflation	-0.1630** (0.0665)	-0.1704** (0.0416)	-0.1555** (0.0647)	-0.1684** (0.0380)
Defense Expenditures (% of Gross Domestic Product)	-0.1268 (0.0856)	-0.1476** (0.0638)	-0.0876 (0.0675)	-0.1155* (0.0572)
Tax Revenues (% of Gross Domestic Product)	0.6088** (0.2248)	0.5656** (0.1368)	0.4666* (0.2016)	0.5440** (0.1245)
Gross Domestic Product (Per Capita)	1.3500** (0.1910)	1.2405** (0.1796)	3.4436** (0.4207)	1.5789** (0.2080)
Total Population	-0.0746 (0.1105)	-0.0621 (0.1279)	-0.1185 (0.1086)	-0.0718 (0.1195)
Constant		-0.0150 (0.1539)		-0.0356 (0.0244)
df	457	500	434	500
R^2	0.2501	0.1959	0.4479	0.1871

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. N = 507. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 57

Estimation Results for All Sample Countries

Gross Domestic Private Fixed Investment Per Capita with Revenue Decentralization

Variable	IV - Within One-Way Country Effects	IV - GLS One-Way Country Effects	IV - Within Two-Way	IV - GLS Two-Way
Revenue Decentralization	-0.1146 (0.0917)	-0.0880 (0.0760)	-0.0148 (0.0821)	-0.0516 (0.0690)
Inflation	-0.1662** (0.0670)	-0.1728** (0.0417)	-0.1556** (0.0653)	-0.1697** (0.0380)
Defense Expenditures (% of Gross Domestic Product)	-0.1182 (0.0821)	-0.1401* (0.0624)	-0.0837 (0.0650)	-0.1100* (0.0571)
Tax Revenues (% of Gross Domestic Product)	0.5703** (0.2194)	0.5352** (0.1378)	0.4567* (0.2002)	0.5259** (0.1251)
Gross Domestic Product (Per Capita)	1.3247** (0.1874)	1.2301** (0.1803)	3.4493** (0.4306)	1.5567** (0.2080)
Total Population	-0.0861 (0.1072)	-0.0723 (0.1273)	-0.1094 (0.1058)	-0.0689 (0.1187)
Constant		-0.0142 (0.0155)		-0.0337 (0.0239)
df	457	500	434	500
R^2	0.2526	0.1975	0.4475	0.1894

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. *N* = 507. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 58

Estimation Results for Sample Developed Countries

Gross Domestic Private Fixed Investment Per Capita with Expenditure Decentralization

Variable	IV - Within One-Way Country Effects	IV - GLS One-Way Country Effects	IV - Within Two-Way	IV - GLS Two-Way
Expenditure Decentralization	0.1273 (0.2715)	0.1338 (0.2200)	0.1173 (0.1558)	0.0582 (0.1611)
Inflation	-0.0223 (0.0818)	-0.0231 (0.1219)	0.0156 (0.0526)	0.0269 (0.0931)
Defense Expenditures (% of Gross Domestic Product)	-0.3840** (0.1402)	-0.3594** (0.1438)	-0.1368 (0.1188)	-0.1675 (0.1125)
Tax Revenues (% of Gross Domestic Product)	0.1596 (0.3503)	0.2034 (0.2774)	0.4102+ (0.2550)	0.4260* (0.2098)
Gross Domestic Product (Per Capita)	1.4769** (0.2229)	1.3680** (0.2563)	4.1513** (0.8228)	1.4914** (0.3157)
Total Population	-1.9432 (3.4872)	-1.4060 (2.0262)	-1.8426 (2.6324)	-0.8828 (1.3610)
Constant		-0.0361 (0.0259)		-0.0460 (0.0335)
df	228	243	205	243
R^2	0.1458	0.1275	0.5963	0.1276

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. N = 250. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 59

Estimation Results for Sample Developed Countries

Gross Domestic Private Fixed Investment Per Capita with Revenue Decentralization

Variable	IV - Within One-Way Country Effects	IV - GLS One-Way Country Effects	IV - Within Two-Way	IV - GLS Two-Way
Revenue Decentralization	-0.7642** (0.2186)	-0.6252** (0.2098)	-0.3756* (0.1778)	-0.4092** (0.1588)
Inflation	-0.1093 (0.0891)	-0.1019 (0.1219)	-0.0176 (0.0510)	-0.0220 (0.0942)
Defense Expenditures (% of Gross Domestic Product)	-0.4483** (0.1393)	-0.4042** (0.1389)	-0.1896+ (0.1171)	-0.2024+ (0.1116)
Tax Revenues (% of Gross Domestic Product)	0.1023 (0.3356)	0.0321 (0.2785)	0.2582 (0.2513)	0.2998 (0.2160)
Gross Domestic Product (Per Capita)	1.4625** (0.2172)	1.3948** (0.2539)	3.8772** (0.8135)	1.5723** (0.3355)
Total Population	-2.8247 (3.6371)	-1.4686 (2.1845)	-2.3260 (2.8796)	-1.0806 (1.6295)
Constant		-0.0350 (0.0268)		-0.0502 (0.0352)
df	228	243	205	243
R^2	0.1855	0.1528	0.6040	0.1539

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. N = 250. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 60

Estimation Results for Sample Developing Countries

Gross Domestic Private Fixed Investment Per Capita with Expenditure Decentralization

Variable	IV - Within One-Way Country Effects	IV - GLS One-Way Country Effects	IV - Within Two-Way	IV - GLS Two-Way
Expenditure Decentralization	-0.1144 (0.1227)	-0.0849 (0.0991)	-0.1256 (0.1044)	-0.1058 (0.0948)
Inflation	-0.1684** (0.0720)	-0.1732** (0.0527)	-0.1616** (0.0668)	-0.1754** (0.0506)
Defense Expenditures (% of Gross Domestic Product)	-0.1039 (0.0925)	-0.1338+ (0.0812)	-0.1207+ (0.0734)	-0.1375+ (0.0770)
Tax Revenues (% of Gross Domestic Product)	0.7252** (0.2571)	0.6943** (0.1816)	0.4727* (0.2245)	0.6040** (0.1769)
Gross Domestic Product (Per Capita)	1.6450** (0.3662)	1.5001** (0.2969)	3.1605** (0.5264)	1.6310** (0.3090)
Total Population	-2.0815* (0.1095)	-1.7153* (0.8159)	-1.5917 (1.0227)	-1.2723 (0.8077)
Constant		0.0338+ (0.0198)		0.0094 (0.0394)
df	224	252	202	252
R^2	0.2924	0.2315	0.4484	0.2282

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. N = 259. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 61

Estimation Results for Sample Developing Countries

Gross Domestic Private Fixed Investment Per Capita with Revenue Decentralization

Variable	IV - Within One-Way Country Effects	IV - GLS One-Way Country Effects	IV - Within Two-Way	IV - GLS Two-Way
Revenue Decentralization	-0.0803 (0.0981)	-0.0483 (0.0968)	-0.0334 (0.0845)	-0.0467 (0.0932)
Inflation	-0.1683* (0.0731)	-0.1726** (0.0539)	-0.1610* (0.0690)	-0.1750** (0.0509)
Defense Expenditures (% of Gross Domestic Product)	-0.0907 (0.0885)	-0.1242 (0.0809)	-0.1069 (0.0706)	-0.1256^{+} (0.0767)
Tax Revenues (% of Gross Domestic Product)	0.6831** (0.2512)	0.6656** (0.1815)	0.4329* (0.2185)	0.5701** (0.1761)
Gross Domestic Product (Per Capita)	1.6361** (0.3631)	1.4990** (0.2984)	3.1944** (0.5443)	1.6319** (0.3109)
Total Population	-1.8968^{+} (1.0372)	-1.6177* (0.8037)	-1.3029 (0.9984)	-1.1428 (0.7983)
Constant		0.0296 (0.0299)		0.0070 (0.0391)
df	224	252	202	252
R^2	0.2904	0.2301	0.4443	0.2270

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. N = 259. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 62

Estimation Results for All Sample Countries

Gross Domestic Public Fixed Investment Per Capita with Expenditure Decentralization

Variable	IV - Within One-Way Country Effects	IV - GLS One-Way Country Effects	IV - Within One-Way Time Effects	IV - GLS One-Way Time Effects
Expenditure Decentralization	0.2494** (0.1000)	0.2251** (0.0854)	0.1863* (0.0930)	0.2037** (0.0823)
Inflation	-0.0168 (0.0696)	-0.0270 (0.0421)	-0.0356 (0.0807)	-0.0292 (0.0408)
Gross Domestic Product (Per Capita)	0.1698 (0.2259)	0.2025 (0.2220)	0.6585* (0.2259)	0.3374+ (0.2000)
Defense Expenditures (Per Capita)	0.5602** (0.0714)	0.5408** (0.0536)	0.4305** (0.0676)	0.5057** (0.0524)
Democratic Governance	-0.0252 (0.0084)	-0.0254** (0.0108)	-0.0291** (0.0053)	-0.0261** (0.0103)
Tax Revenues (% of Gross Domestic Product)	0.1893 (0.2281)	0.1569 (0.1538)	0.1347 (0.2313)	0.1402 (0.1480)
Constant		-0.0102 (0.0209)		-0.0102 (0.0209)
df	457	500	477	500
R^2	0.3015	0.2371	0.3075	0.2371

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. N = 507. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 63

Estimation Results for All Sample Countries

Gross Domestic Public Fixed Investment Per Capita with Revenue Decentralization

Variable	IV - Within One-Way Country Effects	IV - GLS One-Way Country Effects	IV - Within One-Way Time Effects	IV - GLS One-Way Time Effects
Revenue Decentralization	-0.0556 (0.0985)	-0.0086 (0.0849)	-0.0302 (0.0815)	-0.0004 (0.0807)
Inflation	-0.0303 (0.0700)	-0.0420 (0.0424)	-0.0436 (0.0806)	-0.0437 (0.0411)
Gross Domestic Product (Per Capita)	0.1303 (0.2301)	0.1705 (0.2230)	0.6530^{+} (0.3488)	0.3404^{+} (0.2045)
Defense Expenditures (Per Capita)	0.5516** (0.0729)	0.5327** (0.0540)	0.4230** (0.0691)	0.4926** (0.0529)
Democratic Governance	-0.0261** (0.0085)	-0.0262** (0.0109)	-0.0296** (0.0534)	-0.0280** (0.0104)
Tax Revenues (% of Gross Domestic Product)	0.2352 (0.2189)	0.1848 (0.1563)	0.1681 (0.2207)	0.1661 (0.1500)
Constant		-0.0111 (0.0206)		-0.0002 (0.0171)
df	457	500	477	500
R^2	0.2895	0.2278	0.3005	0.2278

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. N = 507. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 64

Estimation Results for Sample Developed Countries

Gross Domestic Public Fixed Investment Per Capita with Expenditure Decentralization

Variable	IV - Within One-Way Country Effects	IV - GLS One-Way Country Effects	IV - Within Two-Way	IV - GLS Two-Way
Expenditure Decentralization	0.7239** (0.2606)	0.7010** (0.2156)	0.5301* (0.2574)	0.5444** (0.2077)
Inflation	-0.2435 (0.1994)	-0.2445* (0.1179)	-0.3208+ (0.1736)	-0.2968** (0.1159)
Gross Domestic Product (Per Capita)	-0.6476* (0.2892)	-0.5127* (0.2704)	0.6751 (0.7455)	0.0701 (0.3722)
Defense Expenditures (Per Capita)	0.7881** (0.0709)	0.7754** (0.0814)	0.5650** (0.0891)	0.6111** (0.0946)
Democratic Governance	-0.4005 (0.3562)	-0.4216+ (0.2580)	-0.4374 (0.3283)	-0.4610* (0.2464)
Tax Revenues (% of Gross Domestic Product)	0.1456 (0.2650)	0.0412 (0.2732)	0.2204 (0.2462)	0.1188 (0.2680)
Constant		-0.0464* (0.0222)		0.0177 (0.0321)
df	228	243	205	243
R^2	0.3363	0.3125	0.4741	0.3125

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. N = 250. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 65

Estimation Results for Sample Developed Countries

Gross Domestic Public Fixed Investment Per Capita with Revenue Decentralization

Variable	IV - Within One-Way Country Effects	IV - GLS One-Way Country Effects	IV - Within Two-Way	IV - GLS Two-Way
Revenue Decentralization	0.2088 (0.3046)	0.1991 (0.2174)	0.2428 (0.2727)	0.1998 (0.1997)
Inflation	-0.2280 (0.1725)	-0.2334* (0.1233)	-0.2930+ (0.1575)	-0.2777** (0.1993)
Gross Domestic Product (Per Capita)	-0.7152** (0.2883)	-0.5562* (0.2768)	0.6534 (0.7376)	0.0716 (0.3515)
Defense Expenditures (Per Capita)	0.7579** (0.2883)	0.7490** (0.0836)	0.5249 (0.0820)	0.5843** (0.0935)
Democratic Governance	-0.5153 (0.3900)	-0.4808+ (0.2633)	-0.5168 (0.3522)	-0.4931* (0.2468)
Tax Revenues (% of Gross Domestic Product)	0.1898 (0.2901)	0.1055 (0.2837)	0.2778 (0.2591)	0.1604 (0.2705)
Constant		-0.0498 (0.0227)		0.0158 (0.0294)
df	228	243	205	243
R^2	0.3100	0.2830	0.4634	0.2830

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. N = 250. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 66

Estimation Results for Sample Developing Countries

Gross Domestic Public Fixed Investment Per Capita with Expenditure Decentralization

Variable	IV - Within One-Way Country Effects	IV - GLS One-Way Country Effects	IV - Within One-Way Time Effects	IV - GLS One-Way Time Effects
Expenditure Decentralization	0.2420* (0.1061)	0.2288* (0.1105)	0.1375 (0.0987)	0.1561 (0.1101)
Inflation	-0.0009 (0.1024)	-0.0090 (0.0613)	-0.0186 (0.0997)	-0.0140 (0.0611)
Gross Domestic Product (Per Capita)	0.9637* (0.4246)	0.7580* (0.3717)	0.7329+ (0.3973)	0.8018** (0.3057)
Defense Expenditures (Per Capita)	0.5131** (0.0850)	0.4857** (0.0740)	0.3822** (0.0754)	0.9757** (0.0753)
Democratic Governance	-0.0225** (0.0089)	-0.0225+ (0.0135)	-0.0274** (0.0062)	-0.0263* (0.0133)
Tax Revenues (% of Gross Domestic Product)	0.1991 (0.2559)	0.1817 (0.2054)	0.2202 (0.2775)	0.1976 (0.2062)
Constant		-0.0049 (0.0337)		-0.0093 (0.0461)
df	224	252	230	252
R^2	0.3139	0.2247	0.3261	0.2247

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. N = 259. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 67

Estimation Results for Sample Developing Countries

Gross Domestic Public Fixed Investment Per Capita with Revenue Decentralization

Variable	IV - Within One-Way Country Effects	IV - GLS One-Way Country Effects	IV - Within One-Way Time Effects	IV - GLS One-Way Time Effects
Revenue Decentralization	0.0882 (0.1082)	0.0497 (0.1111)	-0.0120 (0.0890)	0.0069 (0.1085)
Inflation	-0.0052 (0.1029)	-0.0164 (0.0618)	-0.0222 (0.0995)	-0.0180 (0.0613)
Gross Domestic Product (Per Capita)	0.9119* (0.4439)	0.7057+ (0.3763)	0.7121+ (0.4059)	0.7841** (0.3354)
Defense Expenditures (Per Capita)	0.5027** (0.0865)	0.4748** (0.0756)	0.3746** (0.0771)	0.3874** (0.0755)
Democratic Governance	-0.0234** (0.0091)	-0.0234+ (0.0126)	-0.0278** (0.0062)	-0.0270* (0.0133)
Tax Revenues (% of Gross Domestic Product)	0.2576 (0.2461)	0.2260 (0.2086)	0.2442 (0.2667)	0.2279 (0.2072)
Constant		-0.0033 (0.0333)		-0.0083 (0.0482)
df	224	252	230	252
R^2	0.3016	0.2137	0.3216	0.2137

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. N = 259. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 68

Estimation Results for All Sample Countries

Inflation with Expenditure Decentralization

Variable	IV - Within One-Way Country Effects	IV - GLS One-Way Country Effects	IV - Within One-Way Time Effects	IV - GLS One-Way Time Effects
Expenditure Decentralization	-0.2201^{+} (0.1206)	-0.2625** (0.0934)	-0.1872^{+} (0.1148)	-0.2272* (0.0915)
M2 (% of Gross Domestic Product)	1.9380 (1.2742)	0.1957 (0.2365)	0.1112 (0.3812)	0.1857 (0.2156)
Gross Domestic Product (Per Capita)	-3.1486** (1.8285)	-1.3289** (0.3556)	-1.4964* (0.7823)	-1.5249** (0.3511)
Openness to Trade (% of Gross Domestic Product)	-0.0873 (0.3777)	-0.1853 (0.1161)	-0.0877 (0.3255)	-0.2006 (0.1166)
Tax Revenues (% of Gross Domestic Product)	-0.0409 (0.1884)	-0.0590 (0.1709)	0.0041 (0.1874)	-0.0298 (0.1688)
Gross Domestic Savings (% of Gross Domestic Product)	0.0740* (0.0336)	0.0807^{+} (0.0454)	0.0673 (0.0463)	0.0730** (0.0450)
Constant		-0.0507** (0.0210)		0.0619** (0.0266)
df	411	452	429	452
R^2	0.1743	0.0809	0.1876	0.0780

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. N = 459. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 69

Estimation Results for All Sample Countries

Inflation with Revenue Decentralization

Variable	IV - Within One-Way Country Effects	IV - GLS One-Way Country Effects	IV - Within One-Way Time Effects	IV - GLS One-Way Time Effects
Revenue Decentralization	-0.2873* (0.1303)	-0.3125** (0.0900)	-0.2642* (0.1212)	-0.2923** (0.0877)
M2 (% of Gross Domestic Product)	1.9089 (1.2582)	0.1911 (0.2354)	0.1198 (0.3741)	0.1844 (0.2140)
Gross Domestic Product (Per Capita)	-3.1501** (1.8057)	-1.3398** (0.3540)	-1.5635* (0.7864)	-1.5340** (0.3462)
Openness to Trade (% of Gross Domestic Product)	-0.0878 (0.3738)	-0.1983+ (0.1154)	-0.0952 (0.3233)	-0.2114+ (0.1154)
Tax Revenues (% of Gross Domestic Product)	-0.1420 (0.1967)	-0.1661 (0.1711)	-0.0757 (0.1894)	-0.1260 (0.1680)
Gross Domestic savings (% of Gross Domestic Product)	0.0773** (0.0314)	0.0838+ (0.0451)	0.0680 (0.0440)	0.0752+ (0.0445)
Constant		-0.0518** (0.0209)		0.0637** (0.0253)
df	411	452	429	452
R^2	0.1814	0.0890	0.1963	0.0865

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. N = 459. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 70

Estimation Results for Sample Developed Countries

Inflation with Expenditure Decentralization

Variable	IV - Within One-Way Time Effects	IV - GLS One-Way Time Effects	IV - Within Two-Way	IV - GLS Two-Way
Expenditure Decentralization	-0.0427 (0.1855)	-0.0578 (0.1292)	-0.0240 (0.1180)	-0.0387 (0.1379)
M2 (% of Gross Domestic Product)	0.5884* (0.2742)	0.5848* (0.2707)	1.4082 (1.2854)	0.7873* (0.3390)
Gross Domestic Product (Per Capita)	-0.3290 (0.2757)	-0.4998 (0.3354)	-1.0584 (1.0751)	-0.7095+ (0.4201)
Openness to Trade (% of Gross Domestic Product)	0.1522 (0.1266)	0.2833* (0.1229)	0.1230* (0.1106)	0.2588* (0.1311)
Tax Revenues (% of Gross Domestic Product)	0.2247 (0.2513)	0.2330 (0.1790)	0.1300 (0.1321)	0.2118 (0.1906)
Gross Domestic Savings (% of Gross Domestic Product)	0.0723+ (0.0397)	0.0861** (0.0299)	0.0769* (0.0380)	0.0859** (0.0311)
Constant		-0.0285+ (0.0168)		-0.0322+ (0.0206)
df	178	201	165	201
R^2	0.1532	0.1028	0.1786	0.0984

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. N = 208. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 71

Estimation Results for Sample Developed Countries

Inflation with Revenue Decentralization

Variable	IV - Within One-Way Time Effects	IV - GLS One-Way Time Effects	IV - Within Two-Way	IV - GLS Two-Way
Revenue Decentralization	-0.3397 (0.2392)	-0.3564** (0.1216)	-0.3794 (0.2475)	-0.3777** (0.1318)
M2 (% of Gross Domestic Product)	0.4740+ (0.2538)	0.4810+ (0.2668)	1.2528 (1.2363)	0.6757* (0.3346)
Gross Domestic Product (Per Capita)	-0.2220 (0.3075)	-0.3873 (0.3299)	-1.0934 (1.0450)	-0.6116 (0.4110)
Openness to Trade (% of Gross Domestic Product)	0.1873 (0.1391)	0.2998** (0.1181)	0.1630 (0.1336)	0.2948** (0.1222)
Tax Revenues (% of Gross Domestic Product)	0.1378 (0.2163)	0.1443 (0.1777)	-0.0318 (0.1501)	0.0939 (0.1905)
Gross Domestic Savings (% of Gross Domestic Product)	0.0694* (0.0362)	0.0806** (0.0292)	0.0724* (0.0356)	0.0811** (0.0300)
Constant		-0.0246+ (0.0161)		-0.0263 (0.0190)
df	178	201	165	201
R^2	0.1867	0.1428	0.2103	0.1397

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. N = 208. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 72

Estimation Results for Sample Developing Countries

Inflation with Expenditure Decentralization

Variable	IV - Within One-Way Time Effects	IV - GLS One-Way Time Effects	IV - Within Two-Way	IV - GLS Two-Way
Expenditure Decentralization	-0.0314 (0.1071)	-0.0660 (0.1114)	-0.0422 (0.1004)	-0.0675 (0.1151)
M2 (% of Gross Domestic Product)	-0.3098 (0.4408)	-0.2829 (0.2988)	-0.5520 (1.2427)	-0.3152 (0.3736)
Gross Domestic Product (Per Capita)	-0.8569 (0.9294)	-0.7361 (0.5252)	-0.9780 (1.3642)	-0.7755 (0.6335)
Openness to Trade (% of Gross Domestic Product)	0.3866 (0.2446)	0.3868^{**} (0.1634)	0.4141^{+} (0.2557)	0.3961^{**} (0.1700)
Tax Revenues (% of Gross Domestic Product)	-0.0378 (0.2129)	-0.5001 (0.2092)	-0.0180 (0.1909)	-0.0339 (0.2174)
Gross Domestic Savings (% of Gross Domestic Product)	0.0865 (0.0669)	0.0893 (0.0632)	0.0941^{**} (0.0355)	0.0883 (0.0652)
Constant		-0.0502 (0.0336)		-0.0498 (0.0456)
df	224	246	196	246
R^2	0.1776	0.0879	0.2573	0.0873

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. N = 253. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 73

Estimation Results for Sample Developing Countries

Inflation with Revenue Decentralization

Variable	IV - Within One-Way Time Effects	IV - GLS One-Way Time Effects	IV - Within Two-Way	IV - GLS Two-Way
Revenue Decentralization	-0.0871 (0.0926)	-0.1068 (0.1090)	-0.1115 (0.0854)	-0.1120 (0.1144)
M2 (% of Gross Domestic Product)	-0.2848 (0.4333)	-0.2615 (0.2997)	-0.5637 (1.2519)	-0.2911 (0.3762)
Gross Domestic Product (Per Capita)	-0.9178 (0.9544)	-0.7915 (0.5284)	-1.0535 (1.3839)	-0.8471 (0.6408)
Openness to Trade (% of Gross Domestic Product)	0.3811 (0.2467)	0.3783* (0.1663)	0.4147+ (0.2561)	0.3897* (0.1700)
Tax Revenues (% of Gross Domestic Product)	-0.0582 (0.2105)	-0.0825 (0.2095)	-0.0433 (0.1853)	-0.0666 (0.2173)
Gross Domestic Savings (% of Gross Domestic Product)	-0.0850 (0.0650)	0.0897 (0.0630)	-0.0935** (0.0333)	-0.0885 (0.0650)
Constant		-0.0503 (0.0336)		-0.0501 (0.0462)
df	224	246	196	246
R^2	0.1800	0.0903	0.2600	0.0896

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. N = 253. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 74

Estimation Results for All Sample Countries

Democratic Governance with Expenditure Decentralization

Variable	Within One-Way Time Effects	GLS One-Way Time Effects	Within Two-Way	GLS Two-Way
Expenditure Decentralization	-0.3439 (0.3524)	-0.3645 (0.3213)	-0.2615 (0.3111)	-0.3324 (0.3242)
Gross Domestic Product (Per Capita)	-0.8438 (0.9072)	-0.5466^{+} (0.3313)	-0.6058 (0.6401)	-0.4099 (0.3362)
Openness to Trade (% of Gross Domestic Product)	-1.8151 (1.7804)	-1.5262** (0.4582)	-1.8255 (1.6101)	-1.5614** (0.4667)
Defense Expenditures (% of Gross Domestic Product)	-0.4138 (0.3105)	-0.4178^{+} (0.2538)	-0.4309 (0.2942)	-0.4020 (0.2567)
Total Population	-2.6874 (3.8331)	-2.6549 (2.1590)	-0.7396 (3.0451)	-2.1667 (2.6515)
Constant		0.1565* (0.0739)		0.1622 (0.0966)
df	535	559	491	559
R^2	0.0746	0.0237	0.1748	0.0237

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. N = 565. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 75

Estimation Results for All Sample Countries

Democratic Governance with Revenue Decentralization

Variable	Within One-Way Time Effects	GLS One-Way Time Effects	Within Two-Way	GLS Two-Way
Revenue Decentralization	-0.0173 (0.1873)	-0.0694 (0.3112)	-0.1059 (0.2506)	-0.0086 (0.3152)
Gross Domestic Product (Per Capita)	-0.8612 (0.9214)	-0.5646^{+} (0.3320)	-0.6102 (0.6412)	-0.4213 (0.3371)
Openness to Trade (% of Gross Domestic Product)	-1.8174 (1.7817)	-1.5333** (0.4599)	-1.8227 (1.6067)	-1.5640** (0.4682)
Defense Expenditures (% of Gross Domestic Product)	-0.3736 (0.2781)	-0.3755 (0.2512)	-0.3935 (0.2550)	-0.3606 (0.2538)
Total Population	-2.3471 (3.5453)	-2.3493 (2.1616)	-0.0530 (2.5271)	-1.7175 (2.6502)
Constant		0.1446* (0.0744)		0.1573^{+} (0.0973)
df	535	559	491	559
R^2	0.0725	0.0215	0.1740	0.0215

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. N = 565. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 76

Estimation Results for Sample Developed Countries

Democratic Governance with Expenditure Decentralization

Variable	Within One-Way Time Effects	GLS One-Way Time Effects	Within Two-Way	GLS Two-Way
Expenditure Decentralization	-0.0694 (0.1050)	0.0657 (0.0597)	-0.1094 (0.1515)	-0.0642 (0.0637)
Gross Domestic Product (Per Capita)	-0.0164 (0.0373)	-0.0915 (0.0341)	-0.0770 (0.0616)	-0.0322 (0.0341)
Openness to Trade (% of Gross Domestic Product)	-0.0310 (0.0849)	0.0065 (0.0576)	-0.0844 (0.1064)	-0.0292 (0.0572)
Defense Expenditures (% of Gross Domestic Product)	-0.0055 (0.0396)	0.0067 (0.0400)	-0.0625 (0.0740)	-0.0469 (0.0401)
Total Population	-0.2659 (0.3051)	0.2249 (0.2638)	-0.0945 (0.3973)	-0.3138 (0.2874)
Constant		0.0044 (0.0054)		0.0077 (0.0083)
df	236	260	221	260
R^2	0.0908	0.0100	0.2536	0.0100

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. N = 266. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 77

Estimation Results for Sample Developed Countries [170]

Democratic Governance with Revenue Decentralization

Variable	Within One-Way Time Effects	GLS One-Way Time Effects	Within Two-Way	GLS Two-Way
Revenue Decentralization	0.0539 (0.1135)	0.0509 (0.0549)	-0.1288 (0.1169)	-0.0739 (0.0568)
Gross Domestic Product (Per Capita)	-0.0125 (0.0342)	-0.0065 (0.0344)	-0.0902 (0.0607)	-0.0382 (0.0349)
Openness to Trade (% of Gross Domestic Product)	-0.0242 (0.0844)	-0.0166 (0.0579)	-0.1002 (0.1124)	-0.0378 (0.0578)
Defense Expenditures (% of Gross Domestic Product)	0.0048 (0.0717)	0.0020 (0.0392)	-0.0614 (0.0622)	-0.0463 (0.0394)
Total Population	0.2702 (0.4311)	0.2236 (0.2754)	-0.2419 (0.4877)	-0.0393 (0.3028)
Constant		0.0038 (0.0056)		0.0901 (0.0086)
df	236	260	221	260
R^2	0.0892	0.0100	0.2587	0.0100

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. *N* = 266. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

[170] **, *, + denote significance at the 1%, 5%, and 10% level, respectively. *N* = 300. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimation are not corrected for heteroscedasticity.

Table 78

Estimation Results for Sample Developing Countries

Democratic Governance with Expenditure Decentralization

Variable	Within One-Way Time Effects	GLS One-Way Time Effects	Within Two-Way	GLS Two-Way
Expenditure Decentralization	-0.4160 (0.4312)	-0.4422 (0.4620)	-0.2787 (0.3579)	-0.3792 (0.4694)
Gross Domestic Product (Per Capita)	-1.1290 (1.1178)	-0.5693 (0.5243)	-0.8120 (0.8023)	-0.4361 (0.5366)
Openness to Trade (% of Gross Domestic Product)	-2.2762 (2.1210)	-1.8152** (0.6855)	-2.2532 (1.9046)	-1.8375** (0.7051)
Defense Expenditures (% of Gross Domestic Product)	-0.4961 (0.3778)	-0.4739 (0.3689)	-0.4955 (0.3276)	-0.4438 (0.3771)
Total Population	-4.7248 (5.9484)	-4.7671 (3.4680)	-0.7297 (3.1729)	-3.3274 (3.9390)
Constant		0.2696* (0.1363)		0.2502 (0.1676)
df	271	294	243	294
R^2	0.1036	0.0370	0.1956	0.0327

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. N = 300. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 79

Estimation Results for Sample Developing Countries

Democratic Governance with Revenue Decentralization

Variable	Within One-Way Time Effects	GLS One-Way Time Effects	Within Two-Way	GLS Two-Way
Revenue Decentralization	-0.0089 (0.2496)	-0.0089 (0.4498)	0.1916 (0.3258)	-0.0045 (0.4587)
Gross Domestic Product (Per Capita)	-1.1539 (1.1384)	-0.6000 (0.5249)	-0.8160 (0.8036)	-0.4579 (0.5378)
Openness to Trade (% of Gross Domestic Product)	-2.2702 (2.1168)	-1.8204** (0.6885)	-2.2462 (1.8972)	-1.8394** (0.7075)
Defense Expenditures (% of Gross Domestic Product)	-0.4439 (0.3364)	-0.4210+ (0.3652)	-0.4525 (0.2946)	-0.3965 (0.3729)
Total Population	-4.2019 (5.5535)	-4.3103 (3.4712)	0.1203 (2.5723)	-2.7637 (3.9403)
Constant		0.2633* (0.1270)		0.2410 (0.1692)
df	271	294	243	294
R^2	0.1010	0.0297	0.1950	0.0297

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. N = 300. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 80

Estimation Results for All Sample Countries

Gini Coefficient with Fiscal Decentralization

Variable	Within One-Way Country Effects	GLS One-Way Country Effects	Within One-Way Time Effects	GLS One-Way Time Effects
Expenditure Decentralization	-0.1232 (0.1539)	-0.0911 (0.1306)	-0.0904 (0.1588)	-0.0260 (0.1428)
Gross Domestic Product	0.0834$^+$ (0.0524)	0.0716 (0.0502)	0.0879 (0.0771)	0.0599 (0.0584)
Gross Domestic Investment	-0.0702$^+$ (0.0620)	-0.0971$^+$ (0.0692)	-0.1440$^+$ (0.0889)	-0.1305$^+$ (0.0751)
Openness to Trade	0.1135 (0.0955)	0.0513 (0.0640)	0.0563 (0.1184)	0.0149 (0.0729)
Defense Expenditures	-0.0944$^+$ (0.0883)	-0.1135$^+$ (0.0700)	-0.1385 (0.0973)	-0.1267$^+$ (0.0754)
Health Expenditures	0.0975 (0.0776)	0.0495 (0.0533)	-0.0505 (0.0509)	0.0409 (0.0564)
Constant		0.0120 (0.0193)		0.0052 (0.0094)
df	75	88	68	88
R^2	0.3457	0.0562	0.3196	0.0798

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. N = 95. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 81

Estimation Results for All Sample Countries

Gini Coefficient with Fiscal Decentralization

Variable	Within One-Way Country Effects	GLS One-Way Country Effects	Within One-Way Time Effects	GLS One-Way Time Effects
Revenue Decentralization	-0.2795** (0.0955)	-0.1396 (0.0988)	-0.1722 (0.1202)	-0.1248 (0.1079)
Gross Domestic Product	0.0770 (0.0512)	0.0612 (0.0466)	0.0755 (0.0687)	0.0548 (0.5605)
Gross Domestic Investment	-0.1086* (0.0551)	-0.1381* (0.0614)	-0.1524+ (0.0808)	-0.1443* (0.0702)
Openness to Trade	0.5811 (0.1091)	0.0140 (0.0631)	-0.0472 (0.1235)	-0.0079 (0.0740)
Defense Expenditures	-0.0838 (0.0832)	-0.1022+ (0.0640)	-0.1309 (0.0985)	-0.1224+ (0.0730)
Health Expenditures	-0.0684 (0.0631)	0.0203 (0.0499)	-0.0337 (0.0527)	0.0277 (0.0549)
Constant		0.0088 (0.0081)		0.0593 (0.0091)
df	75	88	68	88
R^2	0.3944	0.0809	0.3415	0.0731

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. N = 95. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 82

Estimation Results for All Sample Countries

Gross Domestic Product Per Capita with Expenditure Decentralization

Variable	IV - Within One-Way Country Effects	IV - GLS One-Way Country Effects	IV - Within One-Way Time Effects	IV - GLS One-Way Time Effects
Expenditure Decentralization	0.0678 (0.0602)	0.0612 (0.0473)	0.0541 (0.0506)	0.0556 (0.0421)
Infant Mortality (Deaths per 1,000 Births)	-0.1361 (0.0966)	-0.1620* (0.0802)	-0.1703+ (0.0927)	-0.1766** (0.0725)
Inflation	-0.0769+ (0.0472)	-0.0709+ (0.0455)	-0.0730+ (0.0436)	-0.0721+ (0.0403)
Gross Domestic Private Investment (Per Capita)	0.2913** (0.1016)	0.2705** (0.0728)	0.2674** (0.0780)	0.2665** (0.0645)
Gross Domestic Public Investment (Per Capita)	0.3360** (0.1146)	0.2554** (0.0728)	0.2136** (0.0887)	0.2176** (0.0620)
Democratic Governance	0.0112** (0.0042)	0.0096** (0.0871)	0.0048* (0.0023)	0.0054 (0.0054)
Constant		0.0587** (0.0087)		0.0250+ (0.0154)
df	461	504	481	504
R^2	0.2070	0.1685	0.3609	0.1685

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. N = 511. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 83

Estimation Results for All Sample Countries

Gross Domestic Product Per Capita with Revenue Decentralization

Variable	IV - Within One-Way Country Effects	IV - GLS One-Way Country Effects	IV - Within One-Way Time Effects	IV - GLS One-Way Time Effects
Revenue Decentralization	-0.0019 (0.0611)	-0.0031 (0.0460)	-0.0234 (0.0470)	-0.0195 (0.0409)
Infant Mortality (Deaths per 1,000 Births)	-0.1464 (0.1001)	-0.1729* (0.0803)	-0.1753* (0.0927)	-0.1832** (0.0725)
Inflation	-0.0798+ (0.0477)	-0.0732+ (0.0455)	-0.0737+ (0.0430)	-0.0730+ (0.0404)
Gross Domestic Private Investment (Per Capita)	0.2727** (0.1022)	0.2648** (0.0725)	0.2664** (0.0782)	0.2649** (0.0646)
Gross Domestic Public Investment (Per Capita)	0.3428** (0.1157)	0.2528** (0.0726)	0.2138** (0.0891)	0.2175** (0.0622)
Democratic Governance	0.0111** (0.0041)	0.0083 (0.0061)	0.0050* (0.0023)	0.0052 (0.0053)
Constant		0.0225** (0.0086)		0.0248+ (0.0150)
df	461	504	481	504
R^2	0.2037	0.1656	0.3592	0.1656

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. $N = 511$. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 84

Estimation Results for Sample Developed Countries

Gross Domestic Product Per Capita with Expenditure Decentralization

Variable	IV - Within One-Way Country Effects	IV - GLS One-Way Country Effects	IV - Within Two-Way	IV - GLS Two-Way
Expenditure Decentralization	-0.1698 (0.1666)	-0.1539 (0.1474)	-0.3254** (0.1169)	-0.2711** (0.1030)
Infant Mortality (Deaths per 1,000 Births)	0.1144 (0.1177)	0.1026 (0.1124)	0.0431 (0.0797)	0.0356 (0.0804)
Inflation	0.1575 (0.1809)	0.1467 (0.1388)	0.0178 (0.0829)	0.0251 (0.0970)
Gross Domestic Private Investment (Per Capita)	0.3800** (0.1395)	0.4105** (0.1266)	0.7168** (0.1683)	0.5275** (0.1201)
Gross Domestic Public Investment (Per Capita)	0.6186** (0.2364)	0.5126** (0.1815)	0.3923** (0.1895)	0.3809** (0.1450)
Democratic Governance	-0.1318 (0.1355)	-0.1161 (0.1769)	-0.0952 (0.0970)	-0.0583 (0.1230)
Constant		0.0248** (0.0117)		0.0238 (0.0206)
df	226	241	203	241
R^2	0.1902	0.1795	0.6777	0.1795

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. N = 248. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 85

Estimation Results for Sample Developed Countries

Gross Domestic Product Per Capita with Revenue Decentralization

Variable	IV - Within One-Way Country Effects	IV - GLS One-Way Country Effects	IV - Within Two-Way	IV - GLS Two-Way
Revenue Decentralization	-0.3866** (0.1538)	-0.3435** (0.1387)	-0.3774** (0.1138)	-0.3338** (0.0965)
Infant Mortality (Deaths per 1,000 Births)	0.0902 (0.1156)	0.0784 (0.1115)	0.0485 (0.0769)	0.0350 (0.0792)
Inflation	0.0996 (0.1953)	0.0957 (0.1391)	-0.0365 (0.0892)	-0.0111 (0.0971)
Gross Domestic Private Investment (Per Capita)	0.3612** (0.1334)	0.3962** (0.1253)	0.6747** (0.1615)	0.5034** (0.1186)
Gross Domestic Public Investment (Per Capita)	0.5201** (0.2299)	0.5237* (0.1803)	0.3717* (0.1838)	0.3780** (0.1428)
Democratic Governance	-0.1223 (0.1492)	-0.0828 (0.1753)	-0.0739 (0.1089)	-0.0294 (0.1215)
Constant		0.0253* (0.0117)		0.0270* (0.0198)
df	226	241	203	241
R^2	0.2098	0.1965	0.6844	0.1965

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. N = 248. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 86

Estimation Results for Sample Developing Countries

Gross Domestic Product Per Capita with Expenditure Decentralization

Variable	IV - Within One-Way Country Effects	IV - GLS One-Way Country Effects	IV - Within One-Way Time Effects	IV - GLS One-Way Time Effects
Expenditure Decentralization	0.0717 (0.0636)	0.0555 (0.0547)	0.0275 (0.0467)	0.0346 (0.0523)
Infant Mortality (Deaths per 1,000 Births)	-0.2185 (0.1923)	-0.2132 (0.1535)	-0.3961* (0.2038)	-0.3442** (0.1449)
Inflation	-0.1302** (0.0541)	-0.1154+ (0.0656)	-0.0590 (0.0568)	-0.0710 (0.0613)
Gross Domestic Private Investment (Per Capita)	0.2133 (0.1440)	0.2163** (0.0939)	0.2789** (0.0908)	0.2710** (0.0874)
Gross Domestic Public Investment (Per Capita)	0.3211* (0.1382)	0.2036** (0.0858)	0.1270 (0.0963)	0.1475+ (0.0890)
Democratic Governance	0.0112** (0.0044)	0.0090 (0.0070)	0.0033 (0.0027)	0.0046 (0.0065)
Constant		0.0172 (0.0120)		0.0095 (0.0199)
df	230	258	236	258
R^2	0.1921	0.1448	0.3234	0.1448

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. *N* = 265. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

Table 87

Estimation Results for Sample Developing Countries

Gross Domestic Product Per Capita with Revenue Decentralization

Variable	IV - Within One-Way Country Effects	IV - GLS One-Way Country Effects	IV - Within One-Way Time Effects	IV - GLS One-Way Time Effects
Revenue Decentralization	-0.0135 (0.0662)	-0.0015 (0.0571)	-0.0038 (0.0424)	-0.0036 (0.0515)
Infant Mortality (Deaths per 1,000 Births)	-0.2079 (0.1900)	-0.2010 (0.1632)	-0.3979* (0.2027)	-0.3461** (0.1450)
Inflation	-0.1305** (0.0543)	-0.1178+ (0.0714)	-0.0584 (0.0567)	-0.0703 (0.0613)
Gross Domestic Private Investment (Per Capita)	0.1955 (0.1462)	0.2082* (0.1090)	0.2801** (0.0906)	0.2710** (0.0875)
Gross Domestic Public Investment (Per Capita)	0.3231* (0.1394)	0.2130* (0.0995)	0.1247 (0.0966)	0.1445+ (0.0795)
Democratic Governance	0.0109** (0.0044)	-0.0092 (0.0072)	0.0032 (0.0027)	-0.0044 (0.0065)
Constant		0.0126 (0.0192)		0.0093 (0.0199)
df	230	258	236	258
R^2	0.1870	0.1413	0.3226	0.1413

Note: **, *, + denote significance at the 1%, 5%, and 10% level, respectively. N = 265. White corrected standard errors are reported in parentheses for the within estimator. The reported standard errors for the GLS estimator are not corrected for heteroscedasticity.

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